Africa RISING

Africa Research in Sustainable Intensification for the Next Generation

USAID's Sustainable Intensification Program in Africa

Africa Research In Sustainable Intensification for the Next Generation (Africa RISING)

Africa RISING Baseline Evaluation Survey (ARBES) Report

Ghana

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The Africa Research In Sustainable Intensification for the Next Generation (Africa RISING) program comprises three research-for-development projects supported by the United States Agency for International Development as part of the U.S. government's Feed the Future initiative.

Through action research and development partnerships, Africa RISING will create opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base.

The three regional projects are led by the International Institute of Tropical Agriculture (in West Africa and East and Southern Africa) and the International Livestock Research Institute (in the Ethiopian Highlands). The International Food Policy Research Institute leads the program's monitoring, evaluation and impact assessment. http://africa-rising.net/

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List of Acronyms and Abbreviations

AR	Africa RISING
FtF	Feed the Future
GARBES	Ghana Africa RISING Baseline Evaluation Survey
GHC	Ghanaian Cedi
IFPRI	International Food Policy Research Institute
IITA	International Institute of Tropical Agriculture
M&E	Monitoring and Evaluation
R4D	Research-for-Development
RISING	Research In Sustainable Intensification for Next Generation
SI	Agricultural Sustainable Intensification
USAID	United States Agency for International Development

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Executive Summary

The Africa Research in Sustainable Intensification for the Next Generation (Africa RISING –AR-) program consists of three research-for-development (R4D) projects supported by the United States Agency for International Development (USAID) as part of the U.S. Government's Feed the Future (FtF) initiative. Through research and development (R&D) partnerships building, Africa RISING aims to create opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified (SI) farming systems that improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base.

The International Food Policy Research Institute (IFPRI) leads an associated project on Monitoring and Evaluation (M&E) of AR activities. As part of the evaluation efforts of the AR program in three regions of northern Ghana (i.e. Northern, Upper West and Upper East), the M&E Team at IFPRI has contracted Pan African Field Services Limited (Panafields) to conduct the Ghana Africa RISING Evaluation Survey (GARBES), which has the primary objective of collecting highly credible and unbiased baseline data to evaluate the effectiveness of AR's activities. In particular, the main development hypothesis that GARBES aims to test is whether AR interventions, in the form of sustainable intensification of agricultural practices, lead to an increase in agricultural productivity, income and welfare indicators (both monetary as well as non-monetary). The collected evidence on the overall effectiveness and on the specific causal pathways will also allow to draw conclusions on whether and how to scale up the program in the future.

The methodology chosen to test the AR research hypotheses in Ghana is a Quasi-Randomized Control Trial (Q-RCT), which is a statistical method used to estimate the causal impact of an intervention on its target population. GARBES collected information on farming households living in 25 communities where AR is implemented and in 25 additional communities identified as controls (i.e. communities with similar characteristics as the AR communities but where the program has not been implemented). Through the comparison of outcomes between these two groups and the application of statistical corrections for sample selection bias, the Q-RCT method is able to compensate for the lack of household random assignment in the first stage of the program design.

The sampling strategy for GARBES is a stratified two-stage random sample, which allows for statistical ex-post inferential analysis. In particular, this sampling strategy considers each development domain as a separate stratum, assumed to be homogenous in terms of basic characteristics (mostly agro-ecological and socio-economic). The first stage consists of the random selection of control communities and the second stage randomly selects households within each community. Following this procedure, 20 households were singled out in each one of the 25 control communities, whereas in the 25 AR communities households were further divided into three sub-groups. The first one includes all households directly benefitting from AR in 2013; the second one is constituted by 6 randomly selected households that expressed interest for participating to AR in 2014; and, finally, the third one includes 8 randomly selected households that will not benefit directly from the program. The last sub-group allows measure eventual spill-over effects generated by the proximity of the beneficiary households.

The assessment of the AR's research hypotheses required the development of multi-topic survey instruments capable of simultaneously gathering reliable data on the main outcomes of interest (such as agricultural productivity, anthropometry, income, food security, poverty) and at the same time controlling for variables that could explain a latent selection bias. As a result, GARBES employed two structured survey tools, the household questionnaire and the community questionnaire, composed respectively of 18 and 8 modules. Furthermore, due the complexity of the survey instruments and the need of minimizing possible sources of measurement error (e.g. data entry errors, non-sampling error more in general), the data

collection was conducted using Computer Assisted Personal Interviewing (CAPI) through the mean of Survey CTO software on Samsung Galaxy tablets.

After three weeks dedicated to training enumerators and piloting the survey instruments, GARBES was implemented in the field from May, 13th to July, 3rd of 2014. The final survey sample size is 1,284 households living in the 50 selected villages. In line with AR target population, all the interviewed households are farming households involved in agriculture at various degrees. Predominantly, they are male-headed Muslim households with relatively low level of education and living in poor housing conditions. Gender discrepancies are persisting and are particularly visible in the light of the land inheritance system. The main crops cultivated are maize, groundnut, rice and beans, with maize being the most widely cultivated crop in all the communities. Environmental constrains are highlighted as one of the main challenges for households living in the selected areas, confirming the need to introduce more sustainable and weather-resistant farming practices in these regions. Overall, descriptive statistics shown in the present report underline the relevance of AR interventions for smallholder farmers' population.

1 Ghana Africa RISING Baseline Evaluation Survey (GARBES)

1.1 Evaluation Design

1.1.1 Africa RISING's development hypotheses

The Africa Research in Sustainable Intensification for the Next Generation (AR) program consists of three agricultural research-for-development (AR4D) projects supported by the United States Agency for International Development (USAID) as part of the U.S. Government's Feed the Future (FTF) initiative.[1] Each one of them operates in one of three "mega-sites" located in West Africa, East and Southern Africa, and the Ethiopian Highlands respectively. The first two are led by the International Institute of Tropical Agriculture (IITA) whereas the latter is led by the International Livestock Research Institute (ILRI). The mega-sites where chosen in order to be representative of the main climatic and human characteristics of these three major regions of Sub-Saharan Africa. In the project areas, the objective of Africa RISING is to create opportunities for smallholder farming households to move out of hunger and poverty through sustainably intensified (SI) farming systems that improve food, nutrition, and income security (particularly for women and children), and at the same time conserve or enhance the natural resource base. The two main FTF overall goals, namely *fostering inclusive agricultural sector growth* and *improving nutritional status of women and children,* are clearly embedded in the objectives of this project. However, AR directly operates only on the former, under the assumption that the latter will benefit indirectly.

The International Food Policy Research Institute (IFPRI) leads an associated project on Monitoring and Evaluation (M&E) of the AR activities. The HarvestChoice team at IFPRI has been charged of evaluating the overall effectiveness of the program, whereas the monitoring activities are shared among research teams on the ground and the IFPRI M&E team. Accordingly, the M&E team operates following the overall work plan (2012), which is annually assessed through subsequent reports (IFPRI, 2014; IFPRI 2015) and is based on the understanding that *monitoring* and *evaluation* are different activities involving multiple priorities and actions.[2] Monitoring focuses on keeping track of the ongoing efficiency by overseeing the main outputs, whereas evaluation specifically deals with "ensuring the effectiveness of the project through the establishment of a causal link from the research outputs to the desired outcomes". Therefore, the AR evaluation is to be intended as the measurement of the quantitative impact of AR innovations on the target population's welfare. As underlined in IFPRI (2014): "Unlike project monitoring, which examines and tracks whether targets have been achieved, impact assessment examines how outcomes of Africa RISING beneficiaries have changed as a direct (and, if modeled explicitly, indirect) effect of the program. It seeks to provide cause-and-effect evidence and quantifies changes in development outcomes that are directly or indirectly attributable to Africa RISING, and not to other confounding actors or factors".

Monitoring and evaluation call for *ad-hoc* rigorous methodologies that differ from each other, but the M&E team also endorses a strategic overview of their overlapping commonalities. For instance, the M&E team, in collaboration with Spatial Development International (an IT spatial private company), developed the Project Mapping and Monitoring Tool (PMMT), which allows licensed users not only to track achievements in FTF goals and to construct interactive maps related to Africa RISING, but also to access the database related to the GARBES survey.[3]

[1] For further references, see: http://www.feedthefuture.gov; http://africa-rising.net; http://africa-rising.wikispaces.com.
[2] See http://africa-rising.wikispaces.com/program_moneval for the annual M&E reports and further documentation.
[3] For further information, please see: http://dev.harvestchoice.org/africarising/

The progress towards the achievement of FTF's goal of reducing poverty through agricultural sustainable intensification is currently monitored through a specific set of indicators, which include FTF's indicators as well as customized indicators, as shown in Table 1.[4] The links between the output indicators on the one hand and to the outcome indicators on the other show the development hypotheses regarding the specific pathways of impact of the AR project (IFPRI, 2012). AR interventions for inclusive agricultural sector growth specifically foresee the production of breeder and foundation seed, the availability of new integrated technology systems, assistance to producer organizations and members as well as the delivery of training (i.e. AR outputs). As a result, targeted farmers are expected to increase on-farm investment thanks to the adoption of new technologies, to experience an increase in agricultural production as well as to implement risk-reducing practices/actions to improve resilience to climate change.

Table 1.1.1: FTF indicators for monitoring the first level objective of fostering inclusive agriculture sector growth

Intermediate result	Outcome Indicators	Output Indicators
Improved agricultural productivity	Gross margin per hectare (whole farm and by system component)	Number of new technologies or management practices: under research; under field testing; made available for transfer
	Number of hectares under improved technologies or management practices	Number of rural households benefitting directly from USG interventions
Expanding market and trade	Value of incremental sales	Number of individuals receiving training
	Farmer satisfaction with quantity, quality and timeliness of extension and input supply services	Number of private enterprises/organization receiving assistance
		Number of producer/community based organization
Increased employment opportunities in targeted value chains	Increase in diversification of off-farm income opportunities for households	Number of individuals receiving training
Increased resilience vulnerable commodities and households	Number of farmers who applied new technologies or management practices	Number of vulnerable household benefitting directly from USG interventions
	Private enterprises/organizations that applied new management practices	
	Stakeholder implementing risk-reducing practices/actions to improve resilience to clime change	

Source: IFPRI M&E Plan, December 2012

Evaluation of AR interventions for sustainable on-farm intensification, therefore, occurs through accurately, reliably, and rigorously measuring whether whole-farm productivity, sales and income (i.e. AR outcomes) have increased *thanks to* the program. The M&E Report (2014) further clarifies that: "the primary

[4] The first set of indicators represent the main tool for systematic reporting to USAID as pointed out in the FTF Indicator Handbook, whereas custom indicators take into account possible specificities of an ad-hoc project not captured by FTF indicators. For a list of such indicators, please refer to the M&E IFPRI's Plan, 2012.

hypothesis of the Africa RISING Program is that sustainable intensification of mixed crop-tree-livestock systems leads to increased whole farm productivity, which in turn leads to development outcomes (improved welfare) such as improved livelihoods (income, assets, capacity, etc.) and better food and nutrition security for those who depend on these systems. It is further hypothesized that a combination of relevant interventions is more likely to increase whole farm productivity than single intervention".

A secondary development hypothesis relates to the potential indirect effects of AR interventions over time and space. Indeed, a crucial research component of AR refers to the measuring of possible *spillover effects*. The hypothesis is that the farmers that live in the AR target communities but did not receive AR intervention will indirectly benefit from it through externalities (e.g. when channeled by successful AR farmers), general equilibrium effects (e.g. depressed maize price through increased maize production due to AR interventions), social and economic interactions and behavioral changes (IFPRI, 2014).

The R4D of AR final goal is to investigate the profitability of scaling up the project and to determine the most efficient ways to do it. Hence, forward-looking analysis aims to explore how productivity and sustainability are impacted by a wide range of technology interventions beyond the current target regions (IFPRI, 2014). Such objective fostered the creation of development domains covering the different typologies of farming systems, which are assumed to be internally homogenous in terms of key characteristics (e.g. population density, rainfall, access to market). The main hypothesis is that any rigorously identified positive impact of AR interventions can be reproduced at a larger scale in regions with the same typology.

1.1.2 Methodology for evaluation: Quasi-Randomized Control Trials (QRCT)

Development hypotheses have not only guided the selection of appropriate indicators for monitoring the progress of the program, but also the choice of the appropriate methodology for its evaluation. Randomized Controlled Trials (RTC) are generally considered as the gold standard of impact evaluation. An RCT is an experimental technique in which eligible individuals or communities are randomly assigned to either receive the intervention (i.e. treatment group) or not (i.e. control group). These settings are inspired by the practices in medical research and are referred to as *experiments*. The randomness feature of the assignment allows the investigator to draw a causal inference between a desired outcome and a given intervention: Since the *ex-ante* differences in both observed and unobserved characteristics between the two groups are idiosyncratic, any significant difference *ex-post* can be attributed to the treatment. The control group represents the *counterfactual*: shows how the treatment group would have evolved in the absence of the treatment.

The RCT methodology is the most rigorous in terms of the internal validity of its results (i.e. causality between treatment and outcome), but it is not exempt of weaknesses. Its main shortcoming refers to the explanatory power of its results to a bigger population: the external validity. In fact, since the randomization allows to ignore all the individual characteristics for the measurement of the impact, there is no way to predict whether the same intervention would be as effective in regions with different features. In addition, the randomization process needs to be embedded at the very beginning of the program design, making it very difficult to implement in a variety of situations.

Since the selection of intervention communities for the Africa RISING implementation was non-random and the household participation within beneficiary villages was voluntary, it was not possible to apply a pure RCT methodology for the evaluation. As the M&E team (IFPRI, 2014) also points out, while Randomized Control Trials are becoming the standard way by which the impacts of a new technology can be assessed, such approach is not applicable in the context of Africa RISING. It is argued that: (i) intervention

communities and households are not selected at random but rather selected purposively by the researcher; (ii) the interventions are not unique: multiple technologies are at play, which vary from community to community and even from household to household; (iii) the attribution of the impact to specific actors or actions is not possible given the multiplicity of players as well as the fact that the interventions are still on-going.

Instead, IFPRI's evaluation design for AR innovations in Ghana foresees a Quasi-Randomized Control Trial (QRCT). A QRCT is an empirical technique used to estimate the causal impact of an intervention on its target population, which is similar to the RCT, but that may be subject to some sample-selection bias arising from the lack of randomness. In the QRCT design the treatment and control groups are not always directly comparable at baseline and thus some statistical corrections may have to recover the true impact. Quasi-experiments are a second best since they are prone to concerns regarding their internal validity (i.e. the capacity of the experiment to assess the causal relationship between the outcome of interest and the treatment itself). Yet, to overcome shortcomings, the IFPRI M&E Team has proposed matching techniques (non-experimental methods) to complement the QRCT and eliminate the selection bias in the estimation.[5]

To test the hypothesis that the AR intervention leads to improved farm productivity and household welfare, one would need to answer the counterfactual question of: "what would have happened to the same communities and households if the project did not take place?". Since it is impossible to know the answer to such a question, GARBES identified a different group of farmers and communities with similar characteristics to the intervention's beneficiaries but that did not have any exposure to the program (IFPRI, 2014). The latter is used to construct the counterfactual. Furthermore, to assess spillover effects of AR, information was collected for a group of *non-intervention households (i.e. non-beneficiary households)* living within the target communities, so that they could benefit from the geographic proximity of the program. Finally, information was also collected for a third group within the target communities: the one including households that will be program beneficiaries in the future (2014). The reason for it is that this first survey will provide a baseline measure for these households to be used in combination with a follow-up survey; therefore providing a panel data structure to improve the measurement accuracy of the project impact.

verall, the Evaluation Design employed by the M&E team to provide evidence about the Program attribution in each country can be structured into the following sequential stages:

(1) Stratification of geographical areas and creation of development domains based on agro-ecological potential;

(2) Selection of action sites in collaboration with national research teams;

(3) Identification of control sites that are in the same development domain as selected action communities;

(4) Household listing to compile a roster of all agricultural households in action and control communities, although sufficiently distant from the latter;

[5] As the M&E IFPRI's Report (2014) highlights: "When there is a non-random selection of target communities and households, various non-experimental designs could be explored to construct a plausible counterfactual group. For example, if selection determinants are known (or believe to be observable), then various regression-based approaches (e.g. matching) can be employed to construct an acceptable comparison group and mitigate selection bias. If selection determinants are (believe to be) unobservable but are thought to be time-invariant, panel data approaches (including simple differences-in-differences) can be employed. When none of the above is possible, the problem of selection bias cannot be addressed and any 'impact evaluation' effort will have to rely heavily on the program theory".

(5) Random sampling of households in control sites to identify valid counterfactual to program beneficiary households;

(6) Random sampling of non-beneficiary households in action communities;

(7) Baseline and follow-up data collection from program beneficiaries, control households, and non-beneficiary household using structured questionnaires;

(8) Analysis aimed at comparing various socio-economic and environmental outcomes of interest among beneficiaries, non-beneficiaries, and control households through regression analysis (e.g. matching) using baseline and follow-up data.

1.1.3 Identification and selections of Action and Control Sites in Ghana

The first steps in the application of the evaluation methodology on the ground were the selection of target beneficiaries as well as the conduction of *ad-hoc* surveys in the identified areas. Since its inception, the IFPRI's HarvestChoice team together with the USAID program design team have adopted a highly-structured approach to geographic targeting, which resulted in the selection of the three geographic areas for the program, namely the West African Guinea Savannah, the Ethiopian Highlands, and the maize- and rice-based systems of East and Southern Africa.[6] In line with the AR's mission, these three regions simultaneously satisfy the criteria of high levels of poverty, high concentration of cereal-based farming systems and low levels of productivity, therefore allowing to reach a large number of individuals in the target typology: poor cereal-based smallholder families.

Within each mega-site, geographical strata (or domains) were identified to represent relatively uniform farming systems where to implement specific sustainable intensification interventions. Given all the constraints, it was not possible to conduct specific research for each one of them so the domains where further classified in terms of the number of potential beneficiaries, infrastructure, environmental concerns and welfare-related characteristics in order to be able to prioritize certain strata on the base of the AR's objectives. In particular, the stratification of project sites was based on the following attributes: farming system, rainfall, elevation (i.e. proxy for temperature), population density and access to markets.

In Northern Ghana three regions were chosen for the study: the Northern, the Upper-East and the Upper-West region. These areas cover both maize-based and rice-vegetables-based systems and therefore allow to address the production constraints characterizing both realities[7]. As IFPRI (2012) highlights, the northern regions of Ghana are characterized by small land holdings and low input - low output farming systems, which adversely impact food security. In particular, they are subject to a seasonal cycle of food insecurity of three to seven months for cereals (i.e., maize, millet and sorghum) and four to seven months for legumes (i.e., groundnuts, cowpeas, and soybeans). These crops in the savannahs are often produced in

[6] Within the AR program, this systematic process of geographical targeting and selection of research action sites has been identified as a significant research contribution (RO1).

[7] The Ghana research team held a stakeholders' workshop in March 2012 to develop its research work plan. Participants identified 20 communities per region, totaling 60 communities, in which to implement research activities. A suggestion was made to revise the selection approach and to reduce the number of communities. A systematic approach following the stratification by Chris Legg should be used to select action research sites in Ghana. Five to nine districts could be selected per district to capture the homogeneity in these administrative units with diverse cropping systems. As IFPRI's Report (2014) recalls, according to the December 20122 Concept Note, "The project will focus on the northern regions of Ghana, specifically in the administrative districts of Karaga, Cheroponi, and Tolon-Kumbungu (Northern Region); Kassena-Nankana and Bawku West (Upper East Region); and Wa East and Nadowli (Upper West Region) to address production constraints in rice and cereal-legume production systems".

a continuous monoculture, steadily depleting soil natural resources and causing the yields per unit area to fall to very low levels. The poverty profile of Ghana identifies the three northern regions as the poorest and most hunger-stricken areas in the country. Gender inequalities are also apparent in these regions, since women have limited access to resources and therefore limited capacity to generate income on their own.

Guo and Azzarri (2013) reviewed available spatial biophysical and socio-economic data layers for northern Ghana and choose the appropriate layers for the stratification. They note that among the candidate layers on population density, Agro-Ecological Zones, precipitation, elevation, slope, farming system, market access, Length of Growth Period (LGP), and land cover, only some were appropriate to characterize and stratify districts in Northern Ghana. Given their spatial variability, Guo and Azzarri (2013) chose LGP and market access as proxies of agriculture potential and socio-economic integration in the food value chain, respectively. Combining these two layers, they derived six unique classes.[8] Based on the stratification analysis and after consultation with local project partners, six action districts were initially identified. However, subsequent field work raised concerns over this first subdivision as for example the high density of rural population in some districts in the Upper East region that were not adequately sampled. As a result, there was a second round of field work that resulted in the identification of ten target districts. Table 1.1.2 summarizes the final list of target districts.

Table 1.1.2: List of districts selected

Region	*Revised Selection*
Northern	Tolon/Kumbungu, Savelugu-Nanton, West Maprusi
Upper West	Wa West, Nadowli, Wa East
Upper East	Kassena-Nankana, Bongo, Talensi-Nabdam

As IFPRI's Report (2014) highlights, to identify action and control sites the following steps were taken. First, all known villages within each district were mapped based on the digital locations provided by AR and on the digitization of printed maps. Also, new market access maps were prepared from the latest available digital maps of roads and tracks and were updated daily as the field work progressed, in order to eliminate inaccessible communities from the list of potential sites. Further, potential communities were selected ex-ante on the basis of a geographic framework ensuring an appropriate distance between action sites and counterfactuals (to avoid contamination), and paper and digital maps were prepared before each day of field work. Once obtained the list of potential beneficiary villages, all the selected communities were visited to check their suitability in terms of farming systems, accessibility and size. The team on the field was composed by the consultant, the project manager and other staff members from IITA, as well as the officers from the Ministry of Agriculture, which were familiar with the district's features. Some pre-selected villages were abandoned, and other suitable sites were identified during the field work. Finally, the locations of all suggested action and counterfactual sites were presented during a planning workshop in Tamale at the end of October 2012.

During the above mentioned workshop, IFPRI raised concerns about the physical closeness of intervetion and counterfactual communities. Hence, some of the sites were abandoned and new ones were chosen as a replacement. The identification of suitable counterfactual communities has been a particularly difficult task, since to obtain a reliable impact assessment they have to present very similar properties as the action

[8] The authors have suggested to choose the intervention communities in five classes/strata, perhaps avoiding the Tamale district (the only one with mid-high LGP and high market access), because its small size would not allow ruling out contamination of control sites given the inevitable proximity to action sites.

communities (i.e. population density, cropping system, market access, etc.), but should also be as far as possible from them to avoid being contaminated by spill-overs. Ideally, inhabitants of counterfactual communities should not meet inhabitants of action villages, and they should not share markets or other public facilities. These two main conditions –similarity and isolation- can very rarely be achieved at once. The best solution would be to have action and counterfactual sites located in different districts, but in northern Ghana this is rarely feasible because of the big differences in market accessibility and cropping systems across them. In addition, there are no major physical barriers to movement such as very large rivers, swamps or mountain ranges allowing to isolate control and treatment sites. In practice, a wide range of approaches were adopted by the IFPRI-led M&E team to obtain the final list of target locations reported in Table 1.1.3 (IFPRI, 2014).

Table 1.1.3: Counterfactual and Intervention communities, GARBES 2014 (n=50)

Control Communities			AR Intervention Communities		
Region	**District**	**Community**	**Region**	**District**	**Community**
Northern R	West Maprusi	Arigu	Northern R	Savelugu-Nanton	Botingli
Northern R	West Maprusi	Basigu	Northern R	Savelugu-Nanton	Duko
Northern R	West Maprusi	Karemiga	Northern R	Savelugu-Nanton	Jana
Northern R	West Maprusi	Kukua	Northern R	Savelugu-Nanton	Kpallung
Northern R	West Maprusi	Laogri	Northern R	Savelugu-Nanton	Tibali
Northern R	West Maprusi	Namiyila	Northern R	Tolon/Kumbungu	Cheyohi No
Northern R	West Maprusi	Nasia	Northern R	Tolon/Kumbungu	Gbanjon
Northern R	Savelugu-Nanton	Disiga	Northern R	Tolon/Kumbungu	Kpirim
Northern R	Savelugu-Nanton	Gushie	Northern R	Tolon/Kumbungu	Tiborgunay
Northern R	Savelugu-Nanton	Kadia	Northern R	Tolon/Kumbungu	Tingoli
Northern R	Savelugu-Nanton	Kpelung	Upper East	Bongo	Sabulungo
Northern R	Savelugu-Nanton	Kukobila	Upper East	Kassena Nankana East	Bonia
Northern R	Savelugu-Nanton	Nabogu	Upper East	Kassena Nankana East	Gia
Northern R	Savelugu-Nanton	Pigu	Upper East	Kassena Nankana East	Nyangua
Northern R	Savelugu-Nanton	Tindan	Upper East	Kassena Nankana East	Tekuru
Upper East	Talensi-Nabdam	Shia	Upper West	Nadowli	Goli
Upper East	Talensi-Nabdam	Yenduri	Upper West	Nadowli	Goriyiri
Upper West	Nadowli	Fian	Upper West	Nadowli	Gyilli
Upper West	Nadowli	Issa	Upper West	Nadowli	Natodor
Upper West	Nadowli	Naro	Upper West	Nadowli	Papu
Upper West	Nadowli	Sa Gie	Upper West	Wa West	Guo
Upper West	Nadowli	Tabiase	Upper West	Wa West	Nyagli
Upper West	Nadowli	Wogu	Upper West	Wa West	Pase
Upper West	Wa East	Goripie	Upper West	Wa West	Siiriyin
Upper West	Wa West	Tanina	Upper West	Wa West	Zanko

Note: There is not an exact correspondence between counterfactual and intervention communities.

Figure 1.1.1: Control and AR Communities, GARBES 2014[9]

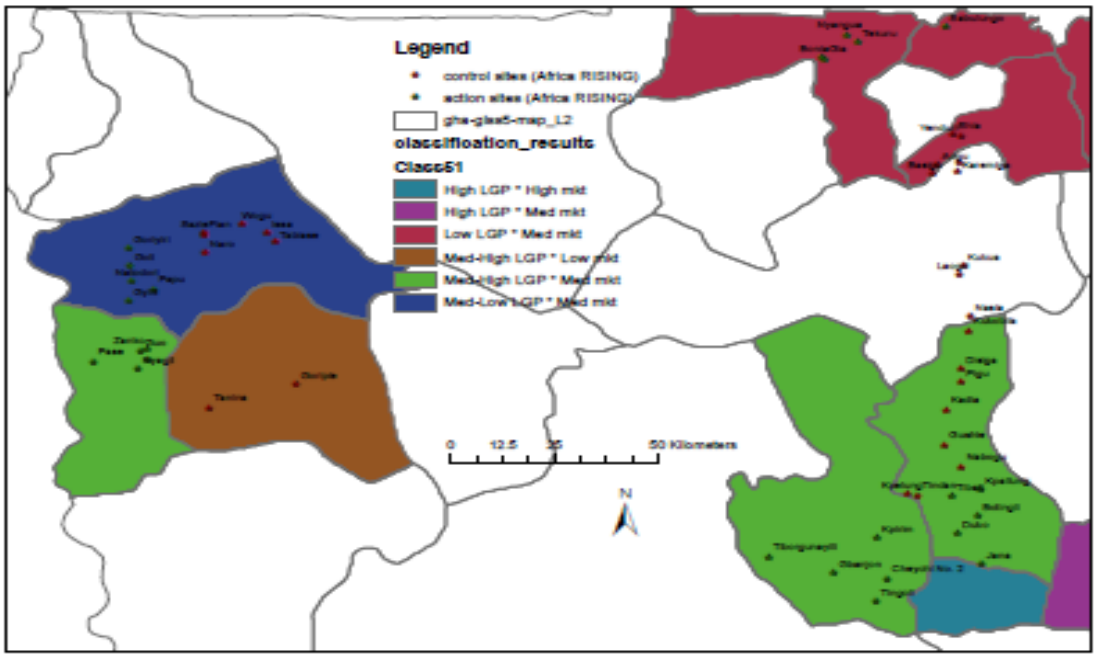

Figure 1.1.1 provides the visual representation of the communities' geographical location. Overall, the evaluation design includes 25 counterfactual communities as well as 25 intervention communities. In particular, 18 communities were selected in the Upper West Region (8 counterfactual communities and 10 intervention communities), 11 communities in the Upper East Region (6 counterfactual communities and 5 intervention communities) and 18 communities in the Northern Region (8 counterfactual communities and 10 intervention communities) (Figure 1). However, during fieldwork, it was noted that an administrative reform of districts took place and there was therefore the need for re-arranging the geographical belonging of some communities. In particular, four communities (Namiyila, Arigu, Basigu, Karemiga) were moved from the Upper East administrative region to the Northern region jurisdiction. In light of this new categorization, Upper East Region finally includes 7 communities (5 intervention communities and 2 control communities) whereas Northern Region covers 25 communities (15 counterfactual and 10 intervention communities). Nevertheless, it is worth underlining that the physical proximity of such communities to the Upper East Region would rather suggest their inclusion in this geographical category for analytical purposes (e.g. similarity in characteristics of its population).

[9] The interactive map is available at the following link: http://www.arcgis.com/home/webmap/viewer.html?webmap=a7e7bd5cd31440cda917c8756bc7ec5a&extent=-4.6785,8.1888,2.0672,11.9954

1.1.4 Sampling design for QRCTs

The households in the selected communities were divided into four groups:

1) Households in control communities;
2) Non-beneficiary households in AR intervention communities;
3) Africa RISING beneficiary households (2013) in AR intervention communities;
4) Africa RISING interested households (2014) in AR intervention communities;

Table 1.1.4: Sample in AR intervention communities, GARBES (2014) (n=795)

Region	District	AR Community	HHs 2013	HHs 2014	Non beneficiary HHs	Total
Northern R	Tolon/Kumbungu	Cheyohi No	22	6	8	36
Northern R	Tolon/Kumbungu	Gbanjon	25	6	8	39
Northern R	Tolon/Kumbungu	Kpirim	11	4	1	16
Northern R	Tolon/Kumbungu	Tiborgunay	18	7	8	33
Northern R	Tolon/Kumbungu	Tingoli	11	7	8	26
Northern R	Savelugu-Nanton	Botingli	17	7	4	28
Northern R	Savelugu-Nanton	Duko	24	8	6	38
Northern R	Savelugu-Nanton	Jana	14	4	8	26
Northern R	Savelugu-Nanton	Kpallung	24	6	8	38
Northern R	Savelugu-Nanton	Tibali	21	6	8	35
Upper East	Kassena Nankana East	Bonia	24	6	8	38
Upper East	Kassena Nankana East	Gia	14	7	8	29
Upper East	Kassena Nankana East	Nyangua	16	6	10	32
Upper East	Kassena Nankana East	Tekuru	19	7	8	34
Upper East	Bongo	Sabulungo	34	7	8	49
Upper West	Wa West	Guo	11	6	8	25
Upper West	Wa West	Nyagli	13	6	8	27
Upper West	Wa West	Pase	13	1	9	23
Upper West	Wa West	Siiriyin	8	6	8	22
Upper West	Wa West	Zanko	13	6	8	27
Upper West	Nadowli	Goli	16	7	7	30
Upper West	Nadowli	Goriyiri	17	3	1	21
Upper West	Nadowli	Gyilli	29	6	8	43
Upper West	Nadowli	Natodor	24	6	8	38
Upper West	Nadowli	Papu	16	7	8	31
Total			454	148	182	**784**

The first step of the sampling strategy consisted in the stratification of the communities on the lines of the development domains at the district level. The second stage randomly selected households within each community. In particular, a constant number of control households (n=20) was randomly selected in each of the 25 control communities for a total of 500 control households. In regard to the 25 intervention communities, the sampling strategy was to randomly select a constant number of households (n=8) not directly benefitting from AR intervention and a constant number of 6 households interested in joining the

program in 2014[10]. Finally, 462 households that directly benefitted from the AR 2013 program were selected to participate to the survey. These guidelines were followed as closely as possible and only in a few cases the number of surveyed households in each group could not exactly match the target.

Table 1.1.4 presents the final sample for the 25 intervention communities in the cropping season of April-December 2013, disaggregated into the three groups of interest. The total sample size for GARBES is 1,284 households, of which 784 households in intervention communities and 500 in control communities. The households in target villages are further divided into 454 AR beneficiaries, 148 AR future beneficiaries and 182 AR non-beneficiaries[11].

1.2 GARBES Tools [12]

In order to provide evidence on the effectiveness of AR interventions as well as to address the main development hypotheses previously stated, GARBES has employed two structured survey instruments: the Household Questionnaire (HQ) and the Community Questionnaire (CQ). Prior to fieldwork, both instruments have been customized to take into account the specific characteristics of the target population (i.e. list of food items consumed in the areas of study).

1.2.1 Household survey tool

The HQ has been specifically designed to collect information on AR's core topics: food security, poverty, agricultural production and productivity as well as nutritional status. Given the high amount of information to be gathered, the survey instrument is divided into two parts to be administered in two separate household's visits (see Appendix 1). Overall, the HQ includes 18 sections, 10 of which covered during the first visit and 8 covered during the second visit.

Module C and D are devoted to anthropometry and allow to evaluate whether the increase in agricultural production leads to an improvement of the nutritional status of the most vulnerable individuals within the household: women and children. In particular, the former collects body measurement of children between 0 to 59 months, whereas the latter carries out anthropometric measurements of women who are in reproductive age (i.e. 15 to 49 years) but that are not pregnant or breastfeeding at the time of the interview. To increase the accuracy of the anthropometric indicators, the survey instrument asked to record the weight and height of the informants up to three times.

A large portion of the HQ is devoted to collect information on agricultural production and livestock rearing. Six modules respectively focus on agricultural land characteristics, crop inputs, agricultural production, livestock ownership and feeding practices. Information is gathered on the parcels of land cultivated by the household, either owned or not. In addition, in a sub-sample of farming households GPS measures of the size of cultivated land were taken by the surveyors, therefore allowing to test the accuracy of self-reported

[10] It is worth underlining that beneficiary household in 2013 refers to any household with at least a member benefitting in the intervention program in the year 2013 irrespective of whether other members of the households registered for the 2014 cropping season. A beneficiary household in 2014 refer to any household with at least a member who claimed to be interested in benefitting from intervention program in the year 2014 irrespective of whether other members of the household will join the program later (i.e. not earlier than 2014).

[11] An additional replacement sample was drawn, representing 30% of the sample size, to cater for attention of non-response.

[12] For further information, please see Azzarri, C. Haile, B, Tinonin, C. GARBES: Technical note, 2014.

areas. Module G looks in depth into the production of crops at the plot level, asking information about different crops that were grown on each plot as well as the different varieties of the crops. In case of intercropping (i.e. multiple crops on the same plot), a 'bean game' has been included in the survey instrument to facilitate the estimation the shares occupied by different crops cultivated on a common plot.[13]

1.2.2 Community survey tool

The community-level data complement the data from the household survey and provides an overview of the socio-cultural and economic environment in the village as well as the access to public services and the most challenges faced by the majority of inhabitants.

Community data are collected through focus group with local leaders and knowledgeable community members as well as market surveys. Through the focus groups, information was collected on access to basic services (Module CC); agricultural labor, extension services and agricultural problems (Module CD); land use and main agricultural practices (Module CE and CF); access to water, main shocks and food consumption (Module CG). In addition, visits to local markets and vendors allowed to collect information on the prices of major food items and the metric conversions of the local food quantity units (Module CH).

1.3 GARBES Planning, Implementation, and Challenges

Pan African Field Services Limited (Panafields) was contracted in April 2014 to implement the survey across the country.[14] The data collection took place between the 12th of May and the 3rd of July 2014 and in the following months, until November 2014, Panafields provided support with the data cleaning process.

1.3.1 Household listing

In the communities selected for the study, a sampling frame (i.e. the universe of reference) was constructed *ex-novo* to list the target population, namely all farming households living in the 50 communities selected for the study. In particular, a farming household has been defined as a household that engages with agriculture either through livestock and/or crops production, irrespective of land ownership (i.e. whether the household owns the land or not). Further, one household refers to one or more people, who share meals and had lived under the same dwelling for at least the three months preceding the interview date.

1.3.2 Recruitment of survey staff

The completion of GARBES has required to contract experienced survey enumerators at the local level, especially in the light of the multiple local language spoken in the areas of interest. To this aim, Panafields

[13] That is, after having laid 50 beans on the ground, the informant is asked to partition the beans proportional to the land area that each crop is planted on, on the referenced plot. Then, by multiplying by two the number of beans for each crop, the tool records the approximate percentage of each crop on the plot.
[14] For further information on the survey firm, please see http://www.panafields.com

advertised online the job opening targeting computer literate local enumerators.[15] In addition to computer literacy, further criteria for selecting applicants were a Bachelor Degree in Agricultural Economics or related, fluency in English, at least one local language spoken in the relevant communities and previous experience in primary data collection. The advertisement was also divulgated among relevant institutions in the target district. Finally, 36 candidates (12 for each region) were selected to attend the training.[16]

1.3.3 Training of survey staff, Programming and Piloting

The GARBES training took place at the Institute of Local Government Studies (ILGS) located in Tamale from 15th April to 8th May. The three weeks of training respectively covered three modules, namely Paper-Based Training (PAPI), Computer-Based Training (CAPI) and Piloting. Given the complexity of the survey instruments, the methodology identified for collecting GARBES is Computer Assisted Personal Interviewing (CAPI).[17] Further, the CAPI programming was conducted through SURVEY CTO, which is based on Open Data Kit (ODK) open source platform.[18]

The Survey CTO software was installed on Samsumg Galaxy Tablets, which constituted the main measurement tools employed during data collection. Further, a pilot phase of the survey instruments into Survey CTO was carried out during the training of enumerators in order to allow time for incorporating feedbacks from the field. The customization of the scripting to the local context as well as the identification of ad-hoc validity checks (e.g. age range, unit of measurements) took place simultaneously during the three weeks of training. In particular, the second week of training was specifically dedicated to instruct enumerators on how to conduct the CAPI interviews, which also involved some practical exercises.

One day during the first and the second week was dedicated to training enumerators in gathering anthropometric data. To this aim, three representatives of the Ghana Nutritional Bureau (GNB) spent the day teaching the enumerators how to use anthropometric scales while controlling for possible measurement error. In addition, they also sensitized the enumerators about the appropriate behavior to adopt during the measurement-taking, especially in regard to children, and administered a practical test to each one of them. The GNB assessment of the enumerators' performance was fully incorporated in the final evaluation of the trainees. Furthermore, to increase accuracy of data, anthropometric training was conducted on the same measurement scales employed during data collection. That is, SECA scales for weighting women in reproductive age and SALTER scale for children aged 0-59; SECA height boards and MUAC tapes for upper arm circumference. The piloting of the survey instrument took place on the third week of training.

1.3.4 Survey teams and organization of fieldwork

In each region, the survey personnel involved one Field Manager, one Quality Assurance Member and two survey teams. Therefore, in total 6 survey teams, 3 Field Managers and 3 Quality Assurance Personals were

[15] The advertisement was posted on http://www.jobberman.com

[16] Specific care was devoted to assure enumerators were not belonging to the communities falling under the area of study.

[17] For further information on CAPI advantages, see for instance http://web.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/EXTPROGRAMS/EXTCOMPTOOLS/0,,contentMDK:23426734~pagePK:64168182~piPK:64168060~theSitePK:8213597,00.html

[18] For further information, please see http://www.surveycto.com/index.html

involved during data collection. Further, each survey team was respectively composed of one supervisor and four enumerators. At the field level, quality assurance was taken at three different stages. First, the supervisors accompanied enumerators to sampled households and controlled certificates of the head of the household to assure that the selected household was part of the sample. Second, before synchronizing the form with the server, the QA went back to the interviewed households to confirm data inputted in the tablets. Third, the survey resident conducted random checks of all survey teams during data collection without prior notice.

2 Summary of GARBES Results

2.1 GARBES-Households

2.1.1 Achievements

In the selected areas of study, GARBES collected information on 1,284 households as well as 10,934 individuals living in these households. In particular, GARBES interviewed 500 households in control communities (control), 182 households living in AR communities but not benefitting from the program (ARNB), 454 households who benefitted from the program during the 2013 cropping season (AR2013), and 148 households who declared to be interested in joining the program in 2014 (AR2014) (Table 2.1.1).
The geographical disaggregation of interviewed households at the regional level shows that the 615 households in the Northern region, 222 households in the Upper East region and 447 households in the Upper West region successfully participated to the survey (Table 2.1.1). In light of the administrative classification of districts revised by the Government of Ghana before data collection, four control communities (i.e. Arigu, Basigu, Karemiga, Namiyila) fall under Savelugu-Nanton District in the Northern Region instead of Upper East region as assumed during the planning stage of the survey design. Table 2.1.2 reports the number of households interviewed at the district level. As a result, in Upper East, solely three districts were involved in the survey, namely Bongo, Kassena Nankana and Talensi-Nabdam. Overall, GARBES was implemented in 10 districts.

Table 2.1.1: Distribution of households by Region and Group, GARBES 2014

	Region			
	Northern	Upper East	Upper West	Total
Control	300	40	160	500
ARNB	67	42	73	182
AR2013	187	107	160	454
AR2014	61	33	54	148
Total	615	222	447	1,284

Table 2.1.2: Distribution of households by District, GARBES 2014

	Tolon/Kumbungu	Savelugu-Nanton	West Mamprusi	Kassena Nankana	Talensi Nabdam	Bongo	Wa west	Wa East	Nadowli	Total
Control		160	140		40		20	20	120	500
ARNB	33	34		34		8	41		32	182
AR2013	87	100		73		34	58		102	454
AR2014	30	31		26		7	25		29	148
Total	150	325	140	133	40	49	144	20	283	1,284

In the 25 control communities, GARBES fruitfully achieved to interview all 500 households (i.e. 100%) as postulated in the ex-ante sample. In this regard, Appendix 2 reports the number of interviewed households in each control community. Overall, 300 households were interviewed in the fifteen control communities in Northern region, 40 households in the two control communities in Upper East region and 160 households in the eight control communities in Upper West region, as also previously specified in Table 1.6. In the 25 intervention communities, GARBES gathered information on 784 households. As Appendix 3 reports, 315 households were interviewed in the ten intervention communities in Northern region, 182 households were interviewed in the five intervention communities in Upper East region and 287 households were interviewed in the ten intervention communities in Upper West region. Further, during data collection, survey teams discovered that some households listed individually were belonging instead to one single unit. Simultaneously, in some communities (e.g. Botingli, Goripie) replaced households were exhausted given the small size of the population. Hence, the discrepancy of eleven intervention households between ex-ante and ex-post sample is explained in light of the impossibility to interview additional households. Overall, GARBES collected information on 182 non beneficiary households living in AR communities, 454 households benefitting from the program in 2013 and 148 households interested in joining the program in 2014. Hence, the achievement for the three groups are respectively 93,81%, 98,26% and 106,47%. Indeed, replaced households for the AR2013 group were drawn from the AR2014 group.

2.1.2 Demography

Table 2.1.3 reports the average household size as well as the age dependency ratio (i.e. the share of people between 15 and 64 years old in the household). Household size is very high in these regions, with an average of 8.51 members and a maximum of 40 members. At the group level, average values are close to the mean of the entire sample. In terms of dependency ratio, the average value for the sample is 43.2%, which is extremely low when compared with the average dependency ratio in Ghana overall (72.2%)[19] and therefore gives an indication of the specific characteristics of the targeted regions. Here as well there are no big differences between the groups. It can be inferred that the households living in the focus communities, which are located in poor rural areas, tend to have a high number of children and therefore present big household sizes and a high share of dependents.

Table 2.1.3: Summary Statistics for Household Size and Dependency Ratio by Group, GARBES 2014

	Control (mean)	ARNB (mean)	AR2013 (mean)	AR2014 (mean)	Total (mean)
Household size	8.51	7.71	9.11	7.66	8.51
Age dep. ratio	43.16	42.01	44.28	41.37	43.20
Age of Head	47.44	46.61	49.15	45.95	47.76

Islam is the predominant religion declared by 52% of heads of households, followed by 33% declaring to be Christian (Table 2.1.4). Traditional religion is also widespread as 13% of the household heads identified it as their belief. Further, the distribution of households by religion at the group level resembles the distribution at the sample level. Given the widespread practice of Islam in the regions, overall almost 28% of heads of the household declared to be involved in a polygamous marriage, whereas the great majority (61%) identified monogamous marriage as their marital status. Among control households, the percentage of polygamous marriages is higher probably due to the higher percentage of Muslim households (Table

[19] World Development Indicators, the World Bank

2.1.4). Further, male-headed households account for 84% of the total, which is in line with the hypothesis of the persistence of gender inequalities in the region. The distribution of male-headed households points out higher percentage among Control (91%) and ARNB (91%) than AR2013 (78%) and AR2014 (71%). Further, the average age of the head of the household in the sample is almost 48 years, whereas in AR2013 is slightly higher (49 years) (Table 2.1.3).

In regard to education, the distribution of the highest grade of education achieved highlights analphabetism as public concern in the selected areas. Overall, almost 75% of heads of household declared that they had not attended school, 10% achieved a grade within primary education, 12% achieved a grade within secondary education and lower percentages reached higher grades (3%). There are no apparent differences between the groups in this regard: the majority of the heads of household in each group never attended school and the higher the level of education considered the fewer the heads falling in such category.

In line with the target population of AR, 93% of the household heads declared to be self-employed in agriculture (the vast majority without employees), whereas 4% stated to be unavailable to work and only 3% identified 'other' as main primary activity. Further, almost the entire sample (95%) has an elementary occupation. The feature of agricultural involvement as main source of employment is also confirmed by the declared trade or business: 98% of the sample stated Agriculture and Forestry as the principal economic sector of its occupation (Table 2.1.4).

At the individual level, GARBES collected demographic information on 10,934 individuals living in selected households, of which 51% are males (Table 2.1.5). In terms of age, the sample mean is 23.43 years with a standard deviation equal to 20.12 years (Table 2.1.6). At the group level, the mean for age does not diverge from the mean of the total sample. Furthermore, for individuals aged 14 years or older, GARBES collected information on their marital status. According to the predominant system of belief in some communities and in line with the trend observed among the household heads, polygamous marriage is still practiced nowadays by 7% of individuals, whereas the great majority (52%) is involved in a monogamous marriage (Table 2.1.5). Furthermore, the indication of the highest grade of education completed speaks for the remoteness of the selected areas of study in terms of literacy rate: 51% of individuals declared they had not attended school, 29% of individuals have declared they achieved a grade within primary education and only 18% attained some level of secondary education. The distribution of languages spoken in the selected communities is another confirmation of the widespread analphabetism. Table 2.1.5 shows that 69% of the individuals do not know how to read and write, whereas 17% speak both English and a local language and 11% speak only English.

2.1.4: Distribution of head of households by selected variables and Group, GARBES 2014

	Control (%)	ARNB (%)	AR2013 (%)	AR2014 (%)	Total (%)
Religion					
Christian	27	37	38	38	33
Muslim	59	47	48	51	52
Traditional	14	15	13	10	13
Other	0	1	1	1	1
Gender					
Male	91	91	78	71	84
Marital status					
Monogamous married	59	65	60	67	61
Polygamous married	32	23	29	18	28
Never married	4	6	2	3	4
Widow(er)	3	4	7	9	5
Other	2	2	2	4	2
Education					
No school/Kindergarten	72	74	78	76	75
Primary	12	7	9	7	10
Secondary	13	17	10	14	12
Tertiary	3	3	3	2	3
Primary Economic Activity					
Self-employed in agriculture without employees	93	86	88	84	89
Self-employed in agriculture with employees	2	7	5	7	4
Unavailable to work	4	4	3	4	4
Other	1	4	4	5	3
Trade or Business					
Agriculture, forestry	99	97	98	97	98
Other	1	3	2	3	2
Occupation					
Elementary occupation	92	96	97	99	95
Manager	8	1	2	0	4
Other	0	3	1	1	1
Total number of households	500	182	454	148	1,284

Note: For marital status, Other includes Living together, "Separated" and Divorced; For Primary Economic Activity, Other includes Self-employed in non-agriculture with and without employees, Hired in agriculture, Hired in non-agriculture, Informal labor (paid), Unpaid family helper in agriculture, Unpaid family helper in non-agriculture, Looking for work; for Trade and Business, other includes all ISIC codes for business sector but not agriculture and forestry; for Occupation, other includes all ISCO codes for occupation but not elementary occupation and manager.

2.1.5: Distribution of individuals by selected variables and Group, GARBES 2014

	Control (%)	ARNB (%)	AR2013 (%)	AR2014 (%)	Total (%)
Gender					
Male	51	51	50	52	51
Marital status					
Monogamous married	52	54	50	55	52
Polygamous married	8	7	8	6	7
Never married	33	30	35	30	33
Widow(er)	5	7	6	7	6
Other	2	2	1	2	2
Education					
No school/ Kindegarten	51	55	49	54	51
Primary	30	26	30	27	29
Secondary	18	19	19	18	18
Tertiary	1	1	1	1	1
Language					
Local languages only	3	1	1	1	2
English	12	10	10	10	11
English and local languages	15	14	19	17	17
Other foreign languages	0	0	0	0	0
Cannot read and write	69	74	68	70	70
Don't know	1	1	1	2	1

Table 2.1.6: Summary Statistics for age by individuals and Group, GARBES 2014

	Control (mean)	ARNB (mean)	AR2013 (mean)	AR2014 (mean)	Total (mean)
Age	23.15	24.12	23.43	23.68	23.44

2.1.3 Agricultural land and production

To evaluate the AR's development hypotheses, GARBES collected detailed information on agricultural production. Table 2.1.7 presents sample means for selected indicators, which are related in particular to agricultural land. GARBES gathered information on 3,139 parcels of land as declared by informants. In terms of size, such parcels average 1.23 hectares each, whereas every household possesses an average of 3.22 hectares of land in total. Further, the average number of parcels per household is 2.48. To increase accuracy, GARBES also investigates agricultural production at the plot level within each parcel.

Every parcel contains on average 1.45 plots. Among control households the average cultivated land size is 4 hectares, among ARNB is 2.56 hectares, among AR2013 is 2.90 hectares and among AR2014 is 2.35 hectares. The average land size is 50% higher among control households than the households in targeted

communities taken together and this difference is significant at the 1% level. Within the targeted communities, treated households (AR2013) present an average land size 14% higher than non-beneficiary households and this difference is as well significant at the 1% level. The same pattern can be found in relation to average number of parcels per household: AR households possess 9% more parcels than non-beneficiary households and the difference is statistically significant. In terms of policy targeting, further research could investigate such differences further.

Table 2.1.7: Sample Mean for selected agricultural variables by Group, GARBES 2014

	Control	ARNB	AR2013	AR2014	Total
Average cultivated land size (ha) by parcel	1.59	1.03	1.05	0.93	1.23
Obs	1,147	425	1,203	364	3,139
Average cultivated land size by hh (ha)	4.00	2.56	2.90	2.35	3.22
Obs	500	182	454	148	1,284
Average number of parcels by hh	2.36	2.36	2.67	2.48	2.48
Obs	500	182	454	148	1,284
Average number of plots by parcel	1.50	1.42	1.43	1.40	1.45
Obs	1,147	425	1,203	364	3,139

Table 2.1.8: Percentage of households who cultivate [CROP], GARBES 2014

	Control (%)	ARNB (%)	AR2013 (%)	AR2014 (%)	Total (%)
Maize	91	88	94	90	91
Groundnut	57	57	62	57	59
Rice	41	50	52	52	47
Bean	25	27	34	36	30
Yam	22	31	29	24	26
Pearl Millet	28	19	23	19	24
Bambara nuts	16	16	16	21	17
Soybean	21	10	15	8	16
Sorghum	12	13	14	13	13
Finger Millet	9	10	10	7	9
Cassava	2	8	7	5	5
Cowpea	5	5	7	2	5
Red Pepper	2	6	3	5	3
Okra	2	2	1	2	2
Chickpea	2	0	0	0	1
Pigeonpea	1	0	0	1	1
Sweet Potato	1	0	1	0	1
Irish Potato	0	1	0	0	0
Total households	**500**	**182**	**454**	**148**	**1,284**

Table 2.1.8 reports the percentage of households who cultivate the different crops. Maize emerges as the most important crop cultivated in the selected areas. Indeed, almost the entire sample (91%) is involved with production of maize. Groundnut and rice are the second and third major crops cultivated, with respectively 59% and 47% of households producing them. Also, bean, yam and pearl millet are important since they are grown by respectively 30%, 26% and 24% of farming households. Bambara nuts, soybean, and sorghum attract a relatively small percentage of agricultural production: 17%, 16% and 13% of households declared to include those crops in their agricultural production. Then, finger millet, cassava, cowpea and red pepper are produced by less than 10% of households. Finally, chickpea, okra, pigeon pea, sweet and Irish potato are the least common crops in the region. When looking at the distribution of crops cultivated by farming households at the group level, pearl millet is particularly relevant among control households, as 28% of them declared their involvement in such crop production. Furthermore, the production of maize is highly present especially within the AR beneficiary households, with a 94% incidence. Also, groundnut and rice are cultivated in higher percentage within treated households compared to other groups (Table 2.1.8).

The distribution of cultivated area by crops confirm the ranking of crops highlighted above (Table 2.1.9). On average, each household cultivates 1.1 hectares with maize, 0.44 hectares with groundnut and 0.41 hectares with rice. Soybean, bean, pearl millet and yam occupy respectively 0.18, 0.15, 0.13 and 0.11 hectares of cultivated land, whereas other crops concern smaller sizes of cultivated land. Overall, 30% of farming households practice intercropping over 18% of plots. On average, 1.20 crops are cultivated in each plot, whereas the average number of intercropped plots is 0.40 for each household. Furthermore, the average size of intercropped plots is 0.47 hectares for each household (Table 2.1.9).

Table 2.1.9: Mean for cultivated area (hectares) by Crop and Group and Intercropping, GARBES 2014

	Control	ARNB	AR2013	AR2014	Total
Cultivated area by hh					
maize	1.39	0.92	0.95	0.80	1.1
groundnut	0.44	0.43	0.48	0.38	0.44
rice	0.47	0.35	0.39	0.34	0.41
Soya bean	0.25	0.11	0.17	0.09	0.18
bean	0.14	0.13	0.17	0.17	0.15
Pearl millet	0.19	0.08	0.11	0.06	0.13
yam	0.1	0.12	0.11	0.09	0.11
sorghum	0.08	0.05	0.05	0.08	0.07
Bambara nuts	0.05	0.05	0.05	0.05	0.05
finger millet	0.05	0.04	0.04	0.02	0.04
cowpea	0.04	0.01	0.02	0.01	0.03
cassava	0.01	0.03	0.03	0.02	0.02
Intercropping					
Average number of crops per plot	1.23	1.20	1.18	1.17	1.20
Average number of intercropped plots at hh	0.44	0.39	0.37	0.33	0.40
Average Intercropped plots area at hh (ha)	0.63	0.39	0.38	0.29	0.47
% hhs practicing intercropping	32	30	29	28	30
% intercropped plots within hh	20	19	16	15	18
Total number of households	**500**	**182**	**454**	**148**	**1,284**

To provide information on agricultural output, Table 2.1.10 reports the sample mean for yields, which measure how much crop is generated from a unit of land expressed as kilograms per hectare. Appendix 4 reports the method of conversion from local units of quantity to kilograms. In regard to GARBES, yam provides the highest yield, with an average value of 7,900 kg/ha, followed by cassava and red pepper with average values equal to 2,126kg/ha and 1941 kg/ha respectively. Rice and maize, which are the main crop produced, have yields of 997 kg/ha and 838 kg/ha. Furthermore, soybean, groundnut and millet present averages values close to 500-600 kg/ha. Despite of their high rankings in regard to cultivated area as well as percentages of households involved in their production, cowpeas, Bambara nuts and beans report the lowest average value in terms of agricultural productivity.

Table 2.1.10: Sample mean for yield by Crop and Group, (kg/ha), GARBES 2014

Yield (kg/ha)	Control	ARNB	AR2013	AR2014	Total
yam	8879.37	6941.33	7913.25	6482.63	7900.83
cassava	2705.78	1933.77	2193.02	1539.08	2126.72
red pepper	709.59	1740.3	2000.1	3371.15	1941.28
rice	1024.43	947.98	956.39	1117.57	996.95
maize	902.57	732.27	831.98	762.72	837.73
groundnut	786.51	590.45	598.6	475.14	643.79
soya bean	574.21	669.59	654.64	448.42	603.1
sorghum	603.13	530.19	593.73	551.05	583.65
finger millet	554.28	667.07	474.56	611.71	550.81
pearl millet	575.45	430.85	551.07	529.94	546.77
cowpea	486.67	385.82	314.84	329.47	391.17
Bambara nuts	368.59	321.66	350.85	381.56	357.94
bean	271.1	366.28	270.98	253.33	281.32

2.1.4 Agricultural inputs

Irrigation appears to be a very rare practice within the sample. Only 3% of households declared to irrigate their land, as Table 2.1.11 shows. The application of manure is a more common since it concerns 24% of farming households. Only 53% of farming households employ hired agricultural labor and similar proportions (58%) apply to exchange labor. This indicates that a large portion of the agricultural effort falls on family labor (Table 2.1.11). The distribution of households using agricultural inputs confirms the general pattern observed at the sample level. Hence, irrigation is practiced by 1% of control households, 3% of ARNB households, 4% of AR2013 households and 6% of AR2014 households. Furthermore, manure is employed as agricultural inputs by 20% of control households, 26% of ARNB households, 34% of AR2013 households and 19% of AR2014 households. Also, the percentage of exchange labor is slightly higher than hired labor for all four groups (Table 2.1.11).

GARBES also investigates the total person-days as agricultural input. As result, Table 2.1.12 points out an average of 269.37 total person-days for the entire sample. Such statistics are further provided for each gender. For male agricultural labor, total person-days is on average 167.15, whereas for female agricultural labor, the mean value is 102.22 total person-days. Moreover, on average each household declared 288.76 GHC as value for the fertilizer used in agricultural production. Households in control communities spend on average 14% more on fertilizer with respect to households in target communities (significant at the 5% level) and, within the target communities, beneficiary households spend 20% more on fertilizer than non-beneficiary households (significant at the 5% level). In terms of seed's expenditure, the average amount spent per household is 20.21 GHC for traditional seeds and 4.97 GHC for improved seeds. There are remarkable differences in improved seeds expenditure between beneficiary households and their non-beneficiary neighbors: the first group spend 2.8 times more than the second and this difference is significant at the 1% level. On the contrary, there are no significant distinctions within the treatment villages in terms of traditional seeds purchases. More rigorous analysis is required to determine whether this factor is a direct consequence of the Africa RISING program (Table 2.1.12).

Table 2.1.11: Percentage of households using agricultural input by Group, GARBES 2014

	Control	ARNB	AR2013	AR2014	Total
hired labor	58	48	51	46	53
exchange labor	60	57	57	56	58
irrigation	1	3	4	6	3
manure	20	26	34	19	24

Table 2.1.12: Total person-days and mean expenditures for agricultural inputs by Group, GARBES 2014

	Control	ARNB	AR2013	AR2014	Total
Persons-days					
Total person-days, male	186.76	146.88	164.52	133.90	167.15
Total person-days, female	111.70	91.74	102.18	83.19	102.22
Total person-days, male & female	298.46	238.62	266.70	217.09	269.37
Value of agricultural input, GHC					
Value of fertilizer purchased per hh	307.15	240.69	298.1	257.05	288.76
Value of traditional seeds purchased per hh	27.76	12.24	17.12	14.01	20.21
Value of improved seeds purchased per hh	5.73	2.34	6.5	1.04	4.97

2.1.5 Agricultural harvest

GARBES has investigated the allocation of the total harvest of each crop to different uses. In this regard, Appendix 4 reports the conversion of measurement units employed to obtain the total harvest in kilograms. As a general pattern, the greatest percentage of total harvest is allocated towards own consumption. Second, the allocation to sales ranks among the main use of total harvest, followed by savings for seeds. Table 2.1.13 shows the percentage of allocation of total harvest to different uses for the four main crops, namely maize, rice, groundnut and bean. For maize, the percentage to own consumption is 74%, whereas 11% is allocated to sale, 6% is saved as seeds and 9% is used as a mean of exchange. In regard to rice, 39% of total harvest is devoted to own consumption whereas 35% is allocated to sales and 16% to saving for seeds. The harvest of groundnut is almost entirely devoted to own consumption, sales and seeds according to the corresponding percentages: 28%, 38% and 27%. Also, the allocation of total harvest of bean is in line with the general pattern identified for the other crops. That is, 69% is allocated to own consumption, 12% to sale and 13% as saved seeds. Even among groups, the general pattern highlighted above can be found. Further, control households appear to devote a slightly less percentage to own consumption than intervention households. Simultaneously, a higher percentage of total harvest to sale is reported for each crop among control household than intervention households.

Among the least common uses, exchange attracts the highest percentage of total harvest for each crop. Thus, 9% of total harvest of maize, 9% of total harvest of rice, 6% of total harvest of groundnut and 6% of total harvest of bean are devoted to exchange at the sample level. Instead, animal feed, crop residue and other uses attract 1% of total harvest respectively for each crop (Table 2.1.13).

Table 2.1.13: Percentage of total harvest of main crops devoted to different uses by Group, GARBES 2014

Main crop	Uses	Control	ARNB	AR2013	AR2014	Total
Maize	Animal feed	1	1	1	1	1
	Crop residue	0	0	0	0	0
	Seeds	7	5	6	4	6
	Exchange	10	7	8	7	9
	Own consumption	67	75	80	80	74
	Sale	15	11	9	7	11
	Other uses	0	0	0	0	0
Rice	Animal feed	0	2	0	0	0
	Crop residue	0	1	0	0	0
	Seeds	19	12	15	16	16
	Exchange	12	6	8	8	9
	Own consumption	36	45	39	37	39
	Sale	32	34	36	39	35
	Other uses	0	0	1	0	1
Groundnut	Animal feed	1	1	0	0	0
	Crop residue	0	1	0	0	0
	Seeds	21	30	31	27	27
	Exchange	7	5	5	7	6
	Own consumption	29	25	29	29	28
	Sale	41	38	35	37	38
	Other uses	0	0	0	0	0
Bean	Animal feed	1	0	1	0	1
	Crop residue	0	0	0	0	0
	Seeds	12	12	13	13	13
	Exchange	6	5	6	5	6
	Own consumption	67	67	69	72	69
	Sale	13	16	11	10	12
	Other uses	1	0	0	0	0

2.1.6 Storage

The distribution of households who had the selected crop in storage confirms the ranking of the most important crops cultivated by households interviewed within GARBES. Thus, at the total sample level 89% of households declared they had maize in storage one month after harvest, followed by 41% and 39% of households stating they had groundnut and rice in storage one month after harvest, respectively. Bean, pearl millet and yam were in storage after harvesting for 27%, 22%, and 20% of households, correspondingly (Table 2.1.14). Table 2.1.15 reports storage facilities used by farming households for main crops. Sacs and bags are the main storage facility employed for maize (95%), pearl millet (80%), rice (96%), bean (80%) and groundnut (95%). The common practice of storing crops using sacks and bags can be found in every group in similar proportions. Among less used facilities, storing crops in granary is a practice for 7% and 5% of farming households in relation to pearl millet and bean, respectively (Table 2.1.15).

It can be expected that not employing granary, or community warehouse or commercial storages (i.e. store rooms) could lead to a loss of harvest due to an easier exposure of sacks and bags to rodents, insects and mold. Indeed, Table 2.1.16 reports that 59% of households lost maize due to insects, 13% of households due to rodents as well as mold. Such percentage is also reported for yam and groundnut. Thus, 60% of households declared they lost yam because of rodents, and 58% lost groundnut for the same reason. On the contrary, theft is claimed merely by 2% of households for maize but not for yam and groundnut. At group level, loss of maize due to insects is identified as main cause by 54% of control households, 70% of ARNB households, 64% of AR2013 households and 56% of AR2014 households. Rodents are a threat for both yam and groundnut in storage as identified by 68% and 60% of control households, 63% and 50% of ARNB group, 53% and 67% of AR2013 group and 56% and 50% of AR2014 group, respectively (Table 2.1.16).

Table 2.1.14: Percentage of households who had crop in storage one month after harvest by Group, GARBES 2014

	Control (%)	ARNB (%)	AR2013 (%)	AR2014 (%)	Total (%)
Maize	88	86	92	88	89
Groundnut	34	47	48	41	41
Rice	30	47	42	47	39
Bean	22	27	30	33	27
Pearl Millet	26	19	20	17	22
Yam	14	27	24	22	20
Bambara Nuts	13	15	14	18	14
Sorghum	11	12	12	12	12
Soybean	13	8	8	6	10
Finger Millet	8	9	9	7	8
Cassava	1	6	6	4	4
Cowpea	3	3	3	0	3
Red Pepper	1	3	2	2	2
Chickpea	2	0	0	0	1
Pigeon bean	1	1	0	1	1
Cotton	1	0	0	0	0
Irish Potato	0	0	0	0	0
Peas	0	0	0	0	0
Sweet potato	0	0	1	0	0
Tomatoes	0	1	0	1	0

Table 2.1.15: Percentage of household using storage facility by selected crops and Group, GARBES 2014

Crop	Storage facility	Control	ARNB	AR2013	AR2014	Total
Maize	Granary	1	0	1	1	1
	Community warehouse and commercial storage	1	0	0	0	0
	Drums	0	0	1	1	0
	Cribs	0	0	0	1	0
	Sacks/bags	91	100	96	95	95
	Raised platforms (roofed & open)	1	0	1	1	1
	Open ground-uncovered & Roof	1	0	0	0	0
	Multiple methods	2	0	0	0	1
	Other	3	0	1	1	2
Pearl Millet	Granary	2	6	14	8	7
	Community warehouse and commercial storage	0	0	0	0	0
	Drums	3	6	4	12	5
	Cribs	0	0	2	0	1
	Sacks/bags	82	82	77	76	80
	Raised platforms (roofed and open)	2	0	0	0	1
	Open ground-uncovered & Roof	2	0	0	0	1
	Multiple methods	5	3	0	0	3
	Other	3	3	2	4	3
Rice	Granary	1	0	0	0	1
	Community warehouse & commercial storage	0	1	0	0	0
	Drums	1	0	0	0	0
	Cribs	1	0	0	0	0
	Sacks/bags	92	98	98	99	96
	Raised platforms (Roofed and open)	2	0	1	0	1
	Open ground-uncovered & Roof	1	0	0	0	1
	Multiple methods	1	0	0	0	0
	Other	1	1	1	1	1
Bean	Granary	9	2	4	0	5
	Community warehouse & commercial storage	0	0	0	0	0
	Drums	8	8	6	10	7
	Cribs	5	2	1	2	3
	Sacks/bags	71	86	84	84	80
	Raised platforms (Roofed and open)	1	0	0	0	1
	Open ground-uncovered & Roof	0	0	1	0	0
	Multiple methods	0	0	1	0	0
	Other	6	2	3	4	4
Groundnut	Granary	1	0	0	0	0
	Community warehouse & commercial storage	0	0	0	0	0
	Drums	0	0	0	2	0
	Cribs	0	0	0	0	0
	Sacks/bags	87	97	99	97	95
	Raised platforms (Roofed and open)	0	1	0	0	0
	Open ground-uncovered & Roof	3	0	0	0	1
	Multiple methods	2	0	0	0	1
	Other	7	2	1	1	3

Table 2.1.16: Percentage of households declaring causes of loss of main crops, GARBES (2014)

	Control (%)	ARNB (%)	AR2013 (%)	AR2014 (%)	Total (%)
Maize					
Rodents	22	0	9	0	13
Insects	54	70	64	56	59
Mold	12	10	9	33	13
Theft	0	0	9	0	2
Multiple reasons	7	20	9	0	9
Other	5	0	0	11	4
Yam					
Rodents	68	63	53	56	60
Insects	4	5	2	0	3
Mold	4	0	5	0	3
Theft	0	0	0	0	0
Multiple reasons	14	26	26	22	22
Other	11	5	14	22	12
Groundnut					
Rodents	60	50	67	50	58
Insects	40	0	0	0	17
Mold	0	50	33	0	17
Theft	0	0	0	0	0
Multiple reasons	0	0	0	50	8
Other	0	0	0	0	0

2.1.7 Livestock

In the last twelve months, the great majority of interviewed households (90%) declared to have raised chicken, followed by goats (local) (72%), as Table 2.1.17 highlights. Further, 48% of households are involved with raising sheeps, whereas 15% of households declared to raise cows (local). Lastly, 12% of households stated they raise pigs (local). All other types of animals attract a very small percentage of households. Having identified the main type of animals raised or produced by interviewed households in the last twelve months, Table 2.1.18 reports the average number of animals per household. As result, on average each household raises 15 chicken, 9 bovines, 6 cattle, 1 pig and 1 type of other animal. Furthermore, the distribution of animal type by household at the group level does not diverge from the total distribution.

In terms of feeding practices, Table 2.1.19 reports the main source of feed for the main categories of animals. Thus, 56% of households identified off-farm (non-purchased) food as main source for feeding large ruminants, followed by 23% of households identifying on-farm food and 19% of household stating multiple sources. Among control households, 76% of households identified off-farm (non-purchased) food as main source of feeding for large ruminants, whereas the distribution among intervention household is closer to the distribution for the entire sample. Also for equines, half sample (50%) claimed off-farm (non-purchased) food as main source of feeding, whereas the remaining half reported on-farm (21%) and multiple sources (27%). For small ruminants, off-farm (non-purchased) food attracts 72% of households as main feeding practice, whereas multiple sources is claimed by 17% of households. For chicken and poultry, 58% and 31% of households declared off-farm and multiple sources, respectively. Lastly, for pigs, 55% and 32% identified off-farm and multiple sources, correspondingly. Moreover, the distribution at the group level confirm the pattern of feeding practices highlighted at the total level (Table 2.1.19).

Table 2.1.17: Percentage of households who raised or produce [animal type] in the last 12 months, GARBES 2014

Animal type	Control (%)	ARNB (%)	AR2013 (%)	AR2014 (%)	Total (%)
Chicken	90	89	91	87	90
Goats-local	66	69	79	77	72
Sheep	38	46	61	49	48
Cows-local	11	20	19	10	15
Pigs-local	9	11	15	20	13
Bulls-local	6	11	7	6	7
Other livestock	7	5	7	9	7
Horse donkey mule	8	2	6	3	6
Draught cattle	3	2	4	1	3
Calves-local	3	5	2	3	3
Bulls-improved	1	1	2	1	1
Cows-improved	1	0	1	1	1
Heifer-local	1	2	1	1	1
Goats-improved	1	2	1	1	1
Fattening cattle-local	0	1	0	0	0
Fattening cattle-improved	0	0	0	1	0
Heifer_improved	0	0	0	0	0
Calves-improved	0	0	0	0	0
Pigs-improved	0	1	0	0	0
Honey bees	0	0	0	0	0

Table 2.1.18: Average number of [Animal Type] owned by household, GARBES 2014

Animal type	Control	ARNB	AR2013	AR2014	Total
Chicken	15	12	16	14	15
Bovines	8	9	11	9	9
Cattle	2	2	12	1	6
Pigs	0	0	1	1	1
Other animal	1	1	1	2	1
Equines	0	0	0	0	0
Beehive	0	0	0	0	0

Table 2.1.19: Distribution of main source of feed for [Animal Category] by Group, GARBES 2014

	Control (%)	ARNB (%)	AR2013 (%)	AR2014 (%)	Total (%)
Large ruminants					
Off- farm (purchased)	3	2	1	0	2
Off-farm (non-purchased)	76	52	43	58	56
On-farm	13	27	30	11	23
Multiple sources	8	17	25	32	19
Equines					
Off -farm (purchased)	5	0	0	0	2
Off-farm (non purchased)	67	25	34	17	50
On-farm	2	25	45	33	21
Multiple sources	26	50	21	50	27
Small ruminants					
Off -farm (purchased)	1	0	1	0	0
Off-farm (non purchased)	76	69	69	71	72
On-farm	5	15	14	13	11
Multiple sources	19	15	16	16	17
Chicken and poultry					
Off- farm (purchased)	2	1	2	1	2
Off-farm (non purchase)	61	54	55	60	58
On-farm	10	11	9	7	9
Multiple sources	27	35	34	32	31
Pigs					
Off -farm (purchased)	15	10	5	0	7
Off-farm (non purchased)	57	48	50	69	55
On-farm	0	14	9	0	6
Multiple sources	27	29	36	31	32

Table 2.1.20 deepens the investigation in regard to feeding practices. For all categories of animals, grazing/open air is the main feeding practices for the majority of the sample. That is, for large ruminants, equines, small ruminants, chicken and poultry and pigs, 81%, 72%, 83%, 61% and 58% of households identified such modality for feeding animals, respectively. Furthermore, at the group level, 93% of control households claimed grazing/open air as main feeding practice for large ruminants, whereas for 83% of AR2013 households is the main feeding for equines. Crop residue plays a secondary role as feeding practice. Thus, at the sample level 12%, 15%, 7%, 17% and 13% of households claimed such modality for each animal category, respectively. In particular, both 50% of ARNB and AR2014 households declared crop residue as used for feeding equines, whereas it is not applied by control households for large ruminants (Table 2.1.20).

Alongside feeding practices, GARBES has also investigated whether households have experienced shortages of drinking water for each animal category. As Table 2.1.21 highlights, informants have not identified shortage of drinking water as a challenge. Thus, for large ruminants, equines, small ruminants, chicken and poultry and pigs, 60%, 71%, 67%, 76% and 73% of households claimed they had rarely or never experienced shortage of water for their animals. On the other side, 32%, 18%, 16%, 16%, and 26% of households stated they had sometimes to face such challenges in relating to feeding large ruminants, equines, small ruminants, chicken and poultry and pigs, respectively (Table 2.1.21).

Table 2.1.20: Percentage of households who used animal feed, GARBES 2014

	Control (%)	ARNB (%)	AR2013 (%)	AR2014 (%)	Total (%)
Large ruminants					
Crop residue	0	17	16	26	12
Green forages	0	0	1	0	0
Grazing/open air	93	77	78	63	81
Legumes, fodder trees	6	5	4	11	5
Multiple	1	0	1	0	1
Other	0	0	0	0	0
Equines					
Crop residue	5	50	17	50	15
Grazing/open air	70	50	83	50	72
Concentrate feeds	5	0	0	0	2
Legumes, fodder trees	16	0	0	0	9
Multiple	5	0	0	0	2
Other	0	0	0	0	0
Small ruminants					
Crop residue	2	10	8	9	7
Green forages	1	1	2	2	2
Grazing/open air	82	84	84	83	83
Concentrate feeds	1	1	0	2	1
Legumes, fodder trees	10	4	4	2	6
Multiple	3	1	2	2	2
Other	0	0	0	0	0
Chicken and poultry					
Crop residue	15	23	17	15	17
Green forages	1	2	2	2	2
Grazing/open air	63	56	62	60	61
Concentrate feeds	1	2	2	5	2
Legumes, fodder trees	11	6	5	1	7
Multiple	4	7	8	10	7
Other	4	4	5	6	4
Pigs					
Crop residue	18	9	17	3	13
Green forages	0	0	1	7	2
Grazing/open air	57	48	55	76	58
Concentrate feeds	5	9	9	7	8
Legumes, fodder trees	5	29	8	4	9
Multiple	15	5	9	3	9
Other	0	0	1	0	1

Table 2.1.21: Percentage of households who experienced shortage of drinking water, GARBES 2014

	Control (%)	ARNB (%)	AR2013 (%)	AR2014 (%)	Total (%)
Large ruminants					
Always	4	2	2	0	3
Often	7	2	4	5	5
Sometimes	39	35	27	26	32
Rarely	15	27	13	11	16
Never	34	32	54	58	44
Equines					
Always	14	0	7	0	10
Often	0	0	3	0	1
Sometimes	28	0	10	0	18
Rarely	12	0	28	0	16
Never	47	100	52	100	55
Small ruminants					
Always	7	1	4	3	5
Often	4	1	4	1	3
Sometimes	27	28	24	22	26
Rarely	15	20	18	20	18
Never	46	48	50	54	49
Chicken and poultry					
Always	8	3	6	4	6
Often	2	1	1	1	1
Sometimes	17	15	16	15	16
Rarely	14	15	18	20	16
Never	58	66	59	60	60
Pigs					
Always	2	0	2	0	1
Sometimes	32	24	27	14	26
Rarely	10	24	24	28	21
Never	55	52	47	59	52

2.1.8 Africa RISING

To investigate informants' knowledge of the program, one section of the questionnaire specifically asked about Africa RISING activities. As Table 2.1.22 reports, for the sample as a whole, 59% of households have heard about the AR project. In particular, 13% of households in control communities heard about AR, whereas in intervention communities 76%, 94% and 88% of households belonging to non-beneficiaries, beneficiaries and interested beneficiaries are knowledgeable about AR, respectively. Further, 58% of the sample claimed its participation to AR. At the group level, 1% of control households (the program was not implemented in these villages), 30% of ARNB, 83% of AR2013 and 63% of AR2014 stated they have participated to AR, correspondingly (Table 2.1.22). Since only the AR2013 households were the direct beneficiaries of the program during the survey year, it can be inferred that Africa RISING activities spread beyond the targeted group and affected other families in the target communities.

Among households declaring their participation to AR, GARBES collected information on the specific type of activity that they attended. Table 2.1.22 provides information also in this regard. In particular,

community meeting is the first activity identified by 23% of informants, followed by trainings and demonstration field days for around 5% of informants each. Among the second activity, trainings are the most common since they concern 20% of the households .

Table 2.1.22: Distribution of households by knowledge of and participation to AR activities, GARBES 2014

	Control (%)	ARNB (%)	AR2013 (%)	AR2014 (%)	Total (%)
% of hhs who heard about AR	13	76	94	88	59
% of hhs who participated to AR	1	30	83	63	58
% of HH's First Activity					
Community meeting	1	16	46	35	23
Trainings	0	5	13	9	6
On-farm experimentation	0	2	12	9	5
Demonstration field days	0	7	13	10	7
Other	0	0	0	1	0
None	99	70	17	37	59
% of HH's Second Activity					
Community meeting	0	3	10	7	5
Trainings	1	13	40	27	20
On-farm experimentation	0	8	15	16	8
Demonstration field days	0	4	14	7	6
Other	0	1	0	0	0
None	99	71	21	43	61

2.1.9 Agricultural-related shocks

A specific section of GARBES explores whether interviewed households experienced agriculture-related shocks in the past five years and whether the latter where between the three worst shocks of that period. As a result, 75% of households reported that between the three worst occurrences of the past five years there was the suffering from at least one agriculture-related shock (Table 2.1.23). In particular, 60% of informants reported that they had suffered from drought or flood. Such percentage is higher among intervention groups than control households, as Table 2.1.23 highlights. Strong winds/storms is identified as an agricultural shock by 23% of households at the total level, whereas the death or theft of livestock was a major reason of distress for 22% of informants.

Table 2.1.23: Percentage of households who ranked agriculture-related shocks among three most important , GARBES (2014)

	Control (%)	ARNB (%)	AR2013 (%)	AR2014 (%)	Total (%)
Agriculture-related shock	74	76	79	78	75
Drought or floods	53	60	66	66	60
Strong winds, storms	21	25	26	22	23
Livestock died or stolen	24	18	22	24	22
Crop diseases or pests	16	12	11	10	13
Large rise in agricultural input prices	6	14	10	10	9
Large rise in prices of food	7	7	6	8	7
Selling crop at lowest prices-need of money	6	1	5	3	4
Severe water shortages	3	5	4	3	3
Large fall is sales prices of crops	1	0	0	0	1
Loss of land	1	3	1	1	1

2.1.10 Housing conditions

To assess housing conditions as proxy for the wealth of the household, GARBES has collected a battery of information regarding the material employed to build the dwelling unit, access to water and type of toilet among others. Table 2.1.24 summarizes the characteristics of the dwelling unit at the household level for the entire sample. As result, the great majority of households (94%) employs mud/clay as main material for its dwelling unit. For a smaller group (6%) cement is instead the material preferred. With regard to the floor, 87% of households identified cement as main material, whereas 11% of households still employ mud for its flooring. More variation in the distribution of characteristics of the dwelling unit is to be found in regard to the material used for the roof. Thus, 49% of households have access to a corrugated metal ceiling, 21% of households employ leaves/raffia and 17% of households manage a combination of the two material for its roof. The picture below provides a visual representation of the typical dwelling unit in the selected areas of study.

Access to drinking water and type of toilet are key information not only to address the wealth of households, but also its hygienic conditions and health environment. Overall, borehole, well and pump is the main category for access to drinking water identified by 66% of households, whereas public tab is the main modality for accessing drinking water for 16% of informants. Further, only 1% of households declared piped into dwelling as main source of drinking water. Given description of dwelling units provided above, it is not surprising that open defecation (bush/field) is the type of toilet for 87% of households in the sample. On the contrary, private KVIP and private latrine are the type of toilet for 3% and 2% of households, respectively. Lastly, for the remaining sample, 5% and 2% of households have access to shared KVIP and shared latrine, correspondingly. Overall, descriptive statistics for housing conditions point out to access to drinking water and type of toilet as areas of public concern for improving standards of living as well as the health environment in selected communities.

Table 2.1.24: Characteristics of housing, GARBES (2014) (n=1,284)

	Control (%)	ARNB (%)	AR2013 (%)	AR2014 (%)	Total (%)
Material for wall					
Mud/mud brick/clay	93	96	93	94	94
Stone/burned bricks	0	0	0	0	0
Cement/sandcrete bloc	6	4	7	6	6
Thatch/cardboard	1	0	0	0	0
Material for floor					
Earth/mud/mud brick	8	14	11	14	11
Wood	0	0	0	1	0
Stone	0	0	0	1	0
Cement/concrete	89	86	88	83	87
Ceramic/tiles	0	0	0	0	0
Other	2	0	1	1	1
Material for roof					
Leaves/raffia/thatch	23	18	20	22	21
Wood	6	5	6	5	6
Corrugated metal	49	55	47	47	49
Cement/concrete	2	1	1	2	1
Asbestos/slate/tiles	4	2	5	6	4
Mud/earth roof (tembe	1	2	3	2	2
A combination	16	17	18	16	17
Source of drinking water					
Piped into dwelling	1	0	1	1	1
Public tap	8	18	21	22	16
Borehole, well & pump	70	68	63	64	66
Well without pump	7	4	5	1	5
Spring	1	3	1	1	1
Pond/Lake/Dam	6	7	6	9	7
River	7	1	4	2	5
Rainwater	0	0	0	0	0
Type of toilet					
Private KVIP	2	1	5	1	3
Shared KVIP	8	2	4	3	5
Private latrine	2	2	3	3	2
Shared latrine	1	2	2	1	2
Bush or field	86	93	85	92	87
Other	0	0	0	1	0
Total number of households	**500**	**182**	**454**	**148**	**1,284**

2.1.11 Anthropometry

2.1.11.1 Children

To assess the nutritional status of children, GARBES has collected weight and height of targeted informants in order to constructs anthropometric indicators. In line with WHO Guidelines (2006), such data are transformed into z-score, which refers to the deviation of an individual's value from the median value of a reference population divided by the standard deviation of the reference population. On such basis, three are the indicators commonly employed in the nutritional assessment of children aged below 59 months, namely stunting, wasting and underweight. Stunting is measured as height-for-age (haz) two z scores below the international reference and is usually an indicator of long-term undernutrition among children. Underweight is measured as weight-for-age (waz) two z-scores below the international reference, whereas wasting is measured as weight-for-height (whz) two z-scores below the international reference. Wasting is commonly used to describe a recent process leading to significant weight loss, usually a consequence of acute starvation or severe disease.

Table 2.1.25 presents summary statistics of z-scores free from implausible values. The sample reports mean values for haz, whz, and waz within the standards, but once the analysis is pushed beyond the mean, indications of severe problems of malnutrition appear. 36% of the sample suffers from stunting, 24% suffers from underweight and 12% suffers from wasting. If we look at the distribution of haz, waz and whz between the different groups in target communities we find no significant differences in terms of haz and whz, but AR2013 do perform significantly better in terms of waz.

Table 2.1.25: Z-scores based on WHO 2006, GARBES 2014

	Control (mean)	ARNB (mean)	AR2013 (mean)	AR2014 (mean)	Total (mean)
haz	-1.51	-1.62	-1.46	-1.52	-1.51
waz	-1.21	-1.28	-1.14	-1.45	-1.22
whz	-0.49	-0.41	-0.37	-0.64	-0.45

Severe stunting (i.e. observations falling below three standard deviations from the reference population) affects 20% of the sample, severe underweight concerns 8% of children and chronic malnutrition is reported in 4% of the sample. Here there are no more visible distinctions between the treated group and the other households. These statistics describe serious nutrition problems in the region.

Table 2.1.26: Moderate malnutrition, GARBES 2014

	Control (%)	ARNB (%)	AR2013 (%)	AR2014 (%)	Total (%)
Stunting	37	37	34	41	36
Underweight	23	26	22	30	24
Wasting	13	12	10	13	12

Table 2.1.27: Severe malnutrition, GARBES 2014

	Control (%)	ARNB (%)	AR2013 (%)	AR2014 (%)	Total (%)
Stunting	20	20	20	22	20
Underweight	8	8	6	10	8
Wasting	4	4	4	6	4

2.1.11.2 Women

GARBES has investigated the nutritional status of women in the reproductive age (i.e. 15-49 years old), who are currently not pregnant or breastfeeding. As result, GARBES allows to construct the Body Mass Index (BMI) for 1,211 women in the sample. At the disaggregated level, the distribution of BMI is reported for 469 women living in control households, 151 women living in ARNB, 464 women living in AR2013 and 127 living in AR2014. Overall, the sample mean of the BMI points out an adequate nutritional status on average (Table 2.1.28). However, the sample also presents individuals with inadequate values of BMI. According to international standard, a BMI below 18.5 indicates underweight, a BMI above 25 indicates overweight and above 30 it indicates obesity. As result, 11% of women suffer from underweight, 14% of women suffer from overweight and 2% is obese. The differences in BMI distribution between the different groups are not statistically significant. It is interesting to notice that a higher percentage of women present problems of overweight rather than underweight, which contrasts the high percentages of malnutrition among children.

Table 2.1.28: Incidence of inadequate Body Mass Index, GARBES 2014

	Control	ARNB	AR2013	AR2014	Total
BMI (mean)	22.0	22.0	21.9	21.8	22.0
N. obs	469	151	464	127	1211
Underweight (%)	13	9	9	13	11
Normal (%)	73	79	77	74	75
Overweight (%)	14	12	14	13	14
Obese (%)	3	1	2	2	2

2.1.12 Conclusion

Results from the household section of this report point out that the majority of households are Muslim, male-headed and characterized by a low level of education. In terms of primary economic activity, all households were involved with agriculture. In particular, maize, bean, rice and groundnut are the main crops to which the majority of land is devoted. Yet, intercropping is practiced by about 30 percent of the total sample and occupy on average 14 percent of the plots. Each households cultivates an area of land of about 3.3 Ha on average, but significant differences can be noticed between households in control and target communities as well as within target communities, depending on whether the household is a direct beneficiary of Africa RISING or not. Further, irrigation is extremely rare in the sample since it is used by only 3% of the households. Most of the sample relies on rainfall only. Application of manure is a more common agricultural practice and concerns 24% of the sampled households.

Given the widespread monetary poverty in selected areas, the allocation of harvest follows a self-subsistence pattern. That is, a great portion of the total harvest is devoted to own consumption, followed by sale and saving for seeds. In terms of storage, farming households give high preference to sacks and bags for all main crops, whereas safer storage modalities (e.g. granary, community warehouse) are seldom used.

Farming households are not only greatly involved with agriculture, but also with raising livestock. In particular, farmers are mainly engaged with raising chicken and goats. In terms of feeding practices, the majority of informants identified off-farm (non-purchased) as main source for feeding animals. At a deeper investigation, grazing/open air is the main feeding practice for all categories of animals. Further, informants have not identified shortage of drinking water as a challenge in raising livestock.

In order to assess the exposure of the target communities to the Africa RISING project, GARBES included a section inquiring about the knowledge and the activities experienced by the households in relation to this program. As expected, only few cases in the control communities have heard of it and none participated to it. Within the target villages, the direct beneficiaries (AR2013) were by far the most exposed to the organized activities but it can be noticed that the other groups obtained some exposure as well. The most common AR activities to which households participated are community meetings, followed by trainings and demonstration field days.

To assess housing conditions as proxy for wealth, GARBES has collected a battery of information regarding the material employed to build the dwelling unit as well as access to water and type of toilet facility. As result, the great majority of households employs mud/clay as main material for its dwelling unit, which is usually floored with cement and roofed with either corrugated metal or leaves/raffia. Overall, borehole, well and pump is the main category for accessing drinking water and open defecation (bush/field) is the type of toilet declared by the great majority of sampled households.

Agricultural shocks appear to be a big source of concern for 75% of the surveyed households. In particular, droughts and floods heavily affected 60% of them, followed in a much smaller proportion by strong winds and storms and by the disappearance of livestock through death or theft.

Finally, GARBES collected anthropometric measures for children and women within the households, which allowed the calculation of the average level of nutrition in the sample as well as the proportion of individuals finding themselves in critical conditions. For both women and children the average measures of nutrition fall in-between the standards. However, despite this encouraging fact, almost 40% of the children still suffer from some degree of stunting and 25% from some level of underweight. Among women dietary problems are less important, with only 11% suffering from underweight and 14% suffering from overweight.

In the next section the report will analyze the information collected at the community level, which captures indications of common agricultural practices, access to basic services and most common solutions applied to the biggest problems.

2.2 GARBES- Community

2.2.1 Achievements

GARBES has successfully conducted community interviews in all 50 communities, which were selected for the study (Table 1.3). Overall, 345 informants were involved in participating to the Community Questionnaire. In particular, Table 2.2.1 shows the distribution of informants by Sex and Group. Among control communities, 136 males and 31 females participated to focus group, whereas among AR communities 143 males and 35 females were involved. Furthermore, in terms of the position hold within the community, among control communities, 35 village leader, 55 village counselors, 53 village development members, 5 religious leaders, 6 teachers as well as 6 individuals occupying a different position were the key informants for providing information on the characteristics of the community. Among AR communities, 20 village chiefs, 53 village counselors, 46 village development members, 9 religious leaders, 2 teachers and 31 individuals occupying a different role and position within the community were all involved in the community questionnaire (Table 2.2.1).

Table 2.2.1: Distribution of Informants by Position hold, Sex and Group, GARBES 2014

	Control		*AR*		*Total*		
	Male	Female	Male	Female	Male	Female	Total
Village Chief	20	15	16	4	36	19	55
Village Counselor	52	3	45	8	97	11	108
VDC	48	5	41	5	89	10	99
Business Man	2	5	4	13	6	18	24
Religious Leader	5		9		14		14
Teacher	5	1	1	1	6	2	8
Other	4	2	27	4	31	6	37
Total	136	31	143	35	279	66	345

Note: VDC refers to Village Development Committee

2.2.2 Availability of community services and travel time to services

The Community questionnaire has investigated the availability of services within each community. Within the agriculture-related services, agricultural extension services are the most available and are provided in 68% of the communities, a veterinary clinic is present in 52% of the communities (32% Control and 72% AR), milk collection centers are available in 30% of the communities (32% control and 28% AR), and a slaughter slab can be found in only 1 AR community (2% of the total) (Table 2.2.2). In regard to education-related services, primary schools are available in almost all sampled communities. That is, 96% of control and 100% of AR communities reported the availability of a primary school within their territory. Also, pre-primary schools are available in 88% of the communities (84% control and 92% AR). Secondary schools are accessible in 86% of the communities (88% control and 84% AR). In regard to health services, hospital and health clinics are existing in 84% communities (76% control and 92% AR). Further, daily markets are available in only 16% communities (20% control and 12% AR), whereas weekly markets are hold in 82% communities (68% control and 96% AR) (Table 2.2.2).

Table 2.2.2: Availability of community services, GARBES 2014 (n=50)

Service	*Control (%)*	*AR (%)*	*Total (%)*
Primary school-the nearest	96	100	98
Milling machine-the nearest	96	88	92
Pre-primary school	84	92	88
Secondary school	88	84	86
Health center/clinic/hospital	76	92	84
Market (weekly)	68	96	82
Police station or post	72	76	74
Agricultural extension service	68	68	68
Bank, mobile money	60	72	66
Bus stop- the nearest	72	60	66
Primary market for livestock	40	84	62
Post office-the nearest	48	72	60
Veterinary centre/clinic	32	72	52
Milk collection center	32	28	30
Community/Publicly tap	8	24	16
Market (daily)	20	12	16
Slaughter slabs	0	4	2

Table 2.2.3: Average travel time to services (minutes), GARBES 2014

Service	*Control*	*AR*	*Total*
Community/Publicly tap	7	6	6
Milk collection center	12	17	14
Pre-primary school	15	14	15
Primary school-the nearest	16	16	16
Bus stop the nearest	11	23	17
Market (daily)	9	32	18
Milling machine-the nearest	9	27	18
Health center/clinic/hospital	29	34	32
Primary market for livestock	26	40	35
Bank, mobile money	41	37	39
Agricultural extension service	41	39	40
Slaughter slabs	.	40	40
Veterinary centre/clinic	44	44	44
Market (weekly)	31	54	45
Police station or post	43	49	46
Post office-the nearest	56	51	53
Secondary school	65	58	61

Table 2.2.4: Availability of agricultural services by activity, GARBES 2014 (n=50)

Service	*Control (%)*	*AR (%)*	*Total (%)*
Livestock management	40	56	48
Planting	32	52	42
Application of herbicide	32	44	38
Application of fertilizer	24	44	34
Harvest	24	44	34
Ploughing	20	44	32
Weeding	20	40	30
Compost Making	12	32	22
Clearing	8	24	16
Irrigation	12	16	14

GARBES has also investigated the average time in minute and one way necessary to reach the service. As Table 2.2.3 shows, pre-primary schools and primary schools are in the immediate proxy as on average 15 and 16 minutes are needed to reach them, respectively. Secondary schools are less accessible since the average time needed to reach them is 61 minutes. In terms of access to health, on average 32 minutes are necessary to reach a hospital/clinic/health service from the community. In terms of agriculture-related services, on average 40 minutes are needed to reach agricultural extension services from the community. Reaching a veterinary clinic from the community takes 44 minutes, whereas a milling machine can be reached in 18 minutes. Further, daily market appear to be more accessible than weekly market: on average one employs 18 minutes to reach a daily market and 45 minutes to reach a weekly market.

A deeper investigation is conducted in relation to services provided by Agricultural Extension Offices. Table 2.2.4 reports the share of communities where specific services are offered. As result, livestock management and planting services are the most available, since they are present in 48% and 42% of the communities respectively. Application of herbicide, fertilizer and harvest services follow with a presence in 38%, 34% and 34% of the communities respectively. Finally, as it appeared already in the household section, irrigation facilities are very seldom available (14% of the communities), forcing the majority of farmers to rely uniquely on rainfall water.

2.2.3 Gendered breakdown of agricultural activities

For each agricultural activity, GARBES gathered information on labor employed. In this regard, Table 2.2.5 presents the gendered breakdown of labor by type (i.e. family, hired and communal). As result, main activities such as harvesting and planting involve all family members (males, females and children) in all communities. In particular, in regard to planting only two communities employ less males than females. Also, for livestock management, children are employed in all fifty communities, whereas 96% of the communities employ males and 92% of the communities employ females. The application of fertilizer also attracts all family members whereas the application of herbicide is a male-oriented activity. In regard of this specific activity, only 42% and 60% communities declared that females and children are employed, respectively. Weeding appears to be a specific activity for which are employed more male and children than females. That is, in only 68% of the communities females are involved in such activity, in contrast with the 98% of communities employing both males and children.

Table 2.2.5: Gendered breakdown of agricultural activities, GARBES 2014 (n=50)

	Control (%)			*AR (%)*			*Total (%)*		
Service	Male	Female	Children	Male	Female	Children	Male	Female	Children
Family labor									
Application-fertilizer	96	96	92	100	96	100	98	96	96
Application-herbicide	100	40	60	96	44	60	98	42	60
Clearing	100	68	100	96	76	96	98	72	98
Compost Making	32	16	12	60	48	60	46	32	36
Harvest	100	100	100	100	100	100	100	100	100
Irrigation	40	32	28	32	28	32	36	30	30
Livestock management	92	88	100	100	96	100	96	92	100
Planting	96	100	100	92	100	100	94	100	100
Ploughing	100	64	92	100	64	100	100	64	96
Weeding	96	64	96	100	72	100	98	68	98
Hired labor									
Application-fertilizer	72	88	76	60	72	72	66	80	74
Application-herbicide	88	28	48	84	12	40	86	20	44
Clearing	100	24	100	80	8	60	90	16	80
Compost Making	8	8	8	8	4	4	8	6	6
Harvest	96	28	100	84	96	96	90	98	98
Irrigation	40	4	28	20	16	20	30	22	24
Livestock management	56	96	36	20	.	8	38	2	22
Planting	68	32	92	56	96	92	62	96	92
Ploughing	96	48	92	100	12	92	98	22	92
Weeding	100	48	96	100	36	100	100	42	98
Communal labor									
Application-fertilizer	72	80	72	56	68	64	64	74	68
Application-herbicide	72	16	24	36	4	8	54	10	16
Clearing	100	48	96	72	32	64	86	40	80
Compost Making	16	12	8	8	8	12	12	10	10
Harvest	96	100	92	80	84	84	88	92	88
Irrigation	16	12	12	12	12	8	14	12	10
Livestock management	28	8	28	8	4	8	18	6	18
Planting	72	100	92	52	84	84	62	92	88
Ploughing	100	44	84	88	20	80	94	32	82
Weeding	100	56	84	100	48	88	100	52	86

When considering hired labor, in all communities males are employed for weeding, whereas only 42% employ females and 98% employ children for the same activity. In regard to harvesting, it is more common to hire children and women (98%) with respect to men (90%). the same is true for the application of

fertilizer: in more communities females (80%) and children (74% communities) are employed than males (66%). The opposite trend is to be found in relation to the application of herbicide: in 86% of the communities males are hired for such activity, whereas in only 20% and 44% of them females and children are engaged, respectively. Livestock management seems to be more related to family labor than hired labor. As Table 2.2.25 shows only in 38% of the communities, males are specifically employed for this activity, whereas only in 1 community (2%) females are also employed and in 22% of the communities children play a role.

Communal labor is greatly employed in regard to harvesting. Thus, in 88%, 92% and 88% of the communities males, females and children are respectively engaged with such activity. Also, the activity of planting appears to be more skewed toward the employment of females and children, as in 92% and 88% communities informants declared the involvement with this type of labor. Weeding is predomintaly a male oriented activity as in all fifty communities communal male labor is employed. The same reasoning appear to apply to clearing and ploughing, for which 86% and 94% communities' informants stated males are involved. On the contrary, livestock management does not greatly involve the inclusion of communal labor: only 18% of the communities use males and children communal labor and 6% of them use female communal labor.

2.2.4 Agricultural problems and solutions

Informants gathered together during focus groups were questioned in regard to main agricultural problems faced by households in the community. Table 2.2.6 shows the results in terms of importance of the problems identified. First in ranking is shortage of agricultural inputs, as it is identified in 26% of the communities, followed by drought in 20% of them. High prices for agricultural inputs is also a major problem identified in 16% of the communities. Such challenges are also reported among the second in order of importance by 18% of the communities (drought), and by 14% of the communities (shortages of agricultural inputs and high prices for agricultural inputs). Among agricultural problems ranked as second, two challenges emerge: in 16% of the communities informants highlighted unfavorable weather conditions, whereas disease is a critical issue affacting households living in 12% of the communities. Moreover, among the third most important problems, shortage of agricultural inputs, high prices for agricultural inputs and crop pests and diseases are all ranked as crucial issues by 12% of the communities. Droughts, diseases and animal death follow with 10% of the communities mentioning them.

Alongside interviewing informants on the main problems faced by households within communities, GARBES has also investigated those startegies implemented in order to overcome challenges. As Table 2.1.7 shows, however, the highest frequency is obtained in relation to the absence of any strategy implemented. This lack of resiliance is particularly skewed toward Control communities, which are showing a much higher percentage of "none" as first strategy in comparison to AR communities. Further, among communities where solutions are actively found, sell/slaughter animal, adjust input use to conditions and increase household's labor share are ranked among the main responses. On the other hand, to participate in labor exchange is very rarely mentioned as a first solution but it becomes important when looking at the second most important strategy. Lastly, among the third most important plans to overcome agricultural problems, adjusting input use to conditions and selling/slaughtering animals are still implemented in 14% and 12% of the communities, respectively.

Table 2.2.6: Most three important agricultural problems, GARBES 2014 (n=50)

	Control (%)	*AR (%)*	*Total (%)*
1st important			
Shortage of agricultural inputs	32	20	26
Drought	20	20	20
High price of agricultural inputs	20	12	16
Low soil fertility	4	12	8
Unfavorable weather conditions	8	8	8
Limited access to drinking water	8	8	8
Disease	0	16	8
Crop pests and diseases	4	0	2
Limited access to veterinary services	4	0	2
None	0	4	2
2nd important			
Drought	20	16	18
Unfavorable weather conditions	24	8	16
Shortage of agricultural inputs	4	24	14
High price of agricultural inputs	12	16	14
Disease	8	16	12
Lack of information	8	4	6
Crop pests and diseases	4	4	4
Poor storage conditions	8	0	4
Limited access to credit	8	0	4
None	0	8	4
Low soil fertility	0	4	2
Limited access to veterinary	4	0	2
3rd important			
Shortage of agricultural inputs	16	8	12
Crop pests and diseases	24	0	12
High price of agricultural inputs	8	12	10
Disease	8	12	10
Animal death	4	16	10
Low soil fertility	4	12	8
Drought	4	12	8
Unfavorable weather conditions	8	8	8
Poor animal housing	4	4	4
Limited access to veterinary	0	8	4
None	8	0	4
Limited access to farming land	0	4	2
Lack of information	4	0	2
Limited access to credit	4	0	2

Table 2.2.7: Most three important strategies, GARBES 2014 (n=50)

	Control (%)	*AR (%)*	*Total (%)*
1st Strategy			
None	60	20	40
Sell/slaughter animal	0	24	12
Adjust input use to conditions	4	16	10
Increase household's labor share	8	8	8
Borrow/Rent/hire farm equipment	12	4	8
Build soil conservation	0	16	8
Participation in labor exchanges	4	4	4
Rent/Hire/share/purchase agricultural land	8	0	4
Use irrigation	0	8	4
Use pesticides	4	0	2
2nd Strategy			
None	8	28	18
Sell/slaughter animal	8	16	12
Participate in labor exchanges	12	8	10
Adjust input use to conditions	8	8	8
Use irrigation	0	12	6
Join farmers' association	12	0	6
Increase household's labor share	0	8	4
Borrow/Rent/hire farm equipment	4	0	2
Use pesticides	0	4	2
Dig bore holes/wells	4	0	2
Rent/hire storage space from others	4	0	2
Postpone sale of produce	0	4	2
Ask advice from family	0	4	2
3nd Strategy			
Adjust input use to conditions	8	20	14
Sell/slaughter animal	8	16	12
None	12	8	10
Participate in labor exchanges	8	8	8
Use pesticides	12	4	8
Migration	8	4	6
Diversify breeds/breeding habits	0	12	6
Other intervention	12	0	6
Borrow/Rent/hire farm equipment	4	4	4
Use irrigation	0	4	2
Build soil conservation	0	4	2
Dig bore holes/wells	0	4	2
Rent/hire storage space from others	0	4	2
Sale produce in piece	4	0	2
Migrate for grazing animal	0	4	2

2.2.5 Land ownership, inheritance and re-allocation of land

In line with statistics at the household level (Table 2.2.4), the persistance of gender inequality in selected areas of study is to be found also in relation to characteristics of communities. For instance, Table 2.2.8 shows that in 78% of the communities only men are entitled to own land. Such phenomenon is particulary relevant among AR communities (92%), but in control communities as well access to land is often only a privilage reserved to males (64%). To further investigate gender bias, in the communities where both man and women can own land, informants were asked whether when a woman dies her husband is entitled to inherit her land. As result, in the majority of such communities (64%) the answer was positive. The same question was also asked in regard to the wife's right to inherit their husband's land in case of his death. In this case 82% the communities allowing for men and women ownership answered positively. However, the most outregous form of gender bias is reported in terms of the status of widows. Table 2.2.8 reports that in 62% of the communities, a widow can be inherited by her husband's brother or other male relative in case of her husband's death.

Alongside land ownership, GARBES has also questioned informants on the occurrence of re-allocation of land due to public intervention. As Table 2.2.8 shows, 34% of the communities experienced appropriation of land for outside investors whereas only 8% saw the reallocation of land cultivated or inhabited by villagers for public use. Further, only in 6% of the communities the District or Central Government declared land as "Reserve Land". The incidence of households affected by such major land related events is not high: on average only 2 households were affected by allocation of land cultivated or inhabited by villagers for public use and appropriation of land for outside investors, respectively. Also, none of the households was affected by District or Central Government declaring land as "Reserve Land" (Table 2.2.9).

Table 2.2.8: Land ownership and inheritance of land, GARBES 2014 (n=50)

	Control	*AR*	*Total*
Gendered land ownership			
Only men	64	92	78
Both men and women	36	8	22
Inheritance of land in case of bi-gender ownership			
Husband inheritance of wife's land	55%	100%	64%
Wife inheritance of husband's land	78%	100%	82%
Widowhood	64	60	62

Table 2.2.9: Re-allocation of land, GARBES 2014 (n=50)

	Control	*AR*	*Total*
Occurrence of re-allocation (%)			
Allocation of land cultivated or inhabited by villagers for public use	8	8	8
Appropriation of land for outside investors	32	36	34
District or Central Government declaring land as "Reserve Land"	8	4	6
Incidence of re-allocation (Number of households affected)			
Allocation of land cultivated or inhabited by villagers for public use	1	3	2
Appropriation of land for outside investors	3	2	2
District or Central Government declaring land as "Reserve Land"	0	1	0

2.2.6 Farmers' cooperatives

In 88% of the communities farmers' cooperatives are an integral part of the life in the village. As Table 2.2.10 shows, on average there are 4 farmers' cooperatives in each village, with an average number of 134 farmers per cooperative. Among the activities of farmers' cooperatives ranked as the most importantthereis knowledge sharing (56% of the communities), followed by physical activities on farm (16%) and group credit (12%). Among the second most important activities, physical activity on farms is crucial in 42% of the communities, followed by group credit in 18% and sharing knowledge in 14% of them. The importance of these two activities (sharing labour and credit among members) is confirmed also by the distribution of activities among the third most important (Table 2.2.10).

Table 2.2.10: Farmers' Cooperatives, GARBES 2014 (n=50)

	Control	*AR*	*Total*
Presence of farmer cooperatives in the community (%)	84	92	88
Average number of farmer cooperative per community	4	4	4
Average number of farmers member per cooperative	180	95	134
First activity (%)			
Sharing knowledge	44	68	56
Physical activities on farms	24	8	16
Group credit	12	12	12
Sharing equipment	0	4	2
Selling output	4	0	2
Second activity (%)			
Physical activity on farms	32	52	42
Group credit	20	16	18
Sharing knowledge	20	8	14
Sharing equipment	4	12	8
Buying inputs	8	4	6
Third activity (%)			
Physical activity on farms	20	28	24
Group credit	20	28	24
Sharing knowledge	16	4	10
Sharing equipment	12	8	10
Selling output	8	12	10
Storing crop	4	4	4

2.2.7 Main crops

Information provided during focus groups substantiate the relevance of maize as main crop in selected areas of study. Table 2.2.11 reports that maize is grown in all communities without exception. Groundnut is cultivated in 86% of the communities, rice in 72%, bean in 44%, yam in 32%, pearl millet in 28% and soybean in 22%. Such ranking follows closely the ranking provided in Table 2.1.18. Furthermore, informants for Community Questionnaire also confirmed that on average the higher percentage of

cultivated land is devoted to maize (38%). Further, 11% of cultivated land is devoted to bean, 1% to groundnut, 18% to millet and 7% to soybean (Table 2.2.11).

Table 2.2.11: Main crops, GARBES 2014 (n=50)

Main crop cultivated	*Control*	*AR*	*Total*
% commucultivating crop			
Maize	100	100	100
Groundnut	88	84	86
Rice	72	72	72
Bean	40	48	44
Yam	28	36	32
Pearl Millet	36	20	28
Soybean	24	20	22
Cowpea	8	4	6
Finger Millet	4	4	4
Other pulses, nuts	0	8	4
Sorghum	0	4	2
Tomatoes	0	4	2
% of cultivated land by main crop			
Maize	38	38	38
Bean	8	14	11
Groundnut	1	1	1
Millet	16	19	18
Soybean	6	7	7

2.2.8 Prevalence of migration

Permanent migration both out of and into the community does not appear to be a relevant phenomenon in terms of magnitude in selected areas. Table 2.2.12 reports that in only 28% of the communities people permanently moved out, with an average number of 3% of total individuals concerned by such migration. Similarly, in 34% of the communities people permanently moved into the village, constituting 2% of the total inhabitants.

Table 2.2.12: Prevalence of Migration, GARBES 2014 (n=50)

	Control	*AR*	*Total*
% Communities where people permanently migrate out	28	28	28
Average % of people	2	4	3
% Communities where people permanently migrate into	40	28	34
Average % of people	2	3	2

2.2.9 Availability of different water sources

Access to water is crucial not only as main determinant of health in developing countries, but also for agricutural production and livestock rearing. GARBES has, therefore, collected information on the main sources of water available in selected areas. As result, in 80% of the communities borehole/well are available, in 68% a lake, pond, river or reservior is a source of water, whereas in only 16% of them piped water can be found (Table 2.2.13). Further, despite the fact that 80% of the communities dispose of a borehole/well, only in 40% of them (32% in total) such source of water is available also for private use. The same observation can be made regarding piped water: despite the fact that 16% of the villages have access to it, there are no villages with this facility available for private use. Such feature is in line with what reported by the household in terms of their housing conditions (Table 2.1.24). Moreover, the great majority of households relies on the water source that is publicly available within the community. For instance, Table 2.2.13 shows that in those communities where borehole is available, on average 90% of the total population relies on it. Also, in the communities where piped water is available, all population relies on such source. Lastly, in all communities the population fully rely on rain as source of water.

Table 2.2.13: Availability of different water sources, GARBES 2014 (n=50)

Water source	*Control*	*AR*	*Total*
Availability (% communities)			
Borehole or well	88	72	80
Lake, pond, river, reservoir	64	72	68
Piped water	8	24	16
Other	8	40	24
Private use (% communities)			
Borehole or well	32	32	32
Piped water	.	.	.
Other	.	8	4
% of population relying on water source			
Borehole or well	90	90	90
Lake, pond, river, reservoir	70	70	70
Piped water	100	100	100
Rain	100	100	100
Other	100	92	93

2.2.10 Prevalence of shocks

With reference to the last agricultural season (i.e. 2013), informants were asked about the occurrence of shocks as well as how many households were affected by them. In terms of coverage, the most important shock was an outbreak of livestock disease or pest, which occurred in 98% of the communities and affected 90% of households. Crop disease or pest takes the second place, with 88% of the communities concerned and 88% of households affected on average. Drought was also a relevant shock, as reported in 86% of the communities. In particular, 98% of households in each village suffered from such environmental constraint. Also, strong winds and storms were reported as major shock in 66% of the communities, affecting 89% of the households. In terms of volatility of agricultural prices, in 64% of the communities a large fall of crop sale price was affected 94% of the households, whereas a large rise in crop input prices happened in 74%

of the communities and damaged on average 97% of households. Further, large rise of price of food occurring in 34% of the communities had negative consequences for 95% of households. Theft, vandalism and robberies are also source of concerns for 40% of the communities and 61% of the households in each of them. Less frequent shocks were fire (26% of the communities and 4% of the households), flooding (22% of the communities and 76% of the households) and loss of land (10% of the communities and 33% of households). Lastly, in 1 control community, political, tribal and farmers' livestock conflict affected 95% of households.

Table 2.2.14: Prevalence of shocks, GARBES 2014 (n=50)

	Control	*AR*	*Total*
Occurrence of shock during last cropping season (2013)			
Outbreak of livestock disease or pest	100	96	98
Crop disease or pest	84	92	88
Drought	76	96	86
Large rise in crop input prices	76	72	74
Strong winds/storms	64	68	66
Large fall in crop sale prices	64	64	64
Theft, vandalism, robberies	28	52	40
Large rise in price of food	40	28	34
Fire	36	16	26
Flood	32	12	22
Loss of land	12	8	10
Other	8	4	6
Political, tribal and farmers' livestock conflict	4	.	2
% of households affected by shock			
Outbreak of livestock disease or pest	95	85	90
Crop disease or pest	92	84	88
Drought	100	96	98
Strong winds/storms	75	89	83
Large fall in crop sale prices	95	93	94
Large rise in crop input prices	99	96	97
Theft, vandalism, robberies	73	55	61
Large rise in price of food	100	90	95
Fire	6	1	4
Flood	74	80	76
Loss of land	37	27	33
Other	100	100	100
Political, tribal and farmers' livestock	95	.	95

2.2.11 Conclusion

The data shows that access to primary education is available in almost the entirety of the surveyed communities and is reachable through a short commuting time (around 15 minutes on average). Access to health facilities is also widespread, since it is readily available in 84% of the communities in the sample. In terms of agriculture-related facilities the picture is more nuanced: if milling machines are available in 92%

of the communities, veterinary services, milk collection centers and slaughter slabs are much rarer and require more time to be reached.

In terms of division of labor, the surveyed communities tend to rely heavily on family labor and utilize hired or communal labor only for some key activities such as harvesting. Some agricultural activities are characterized by a strong gender connotation: application of herbicide, clearing, ploughing, weeding and livestock management tend to be performed by men, whereas planting and fertilizer application is more commonly done by women.

The information collected in terms of most commonly cultivated crops overall confirms the picture emerging from the data at the household level. Thus, maize is cultivated in all fifty communities, followed by groundnut, rice and beans. Between the most important agricultural problems faced by the villages there are the shortage or high price of agricultural inputs and droughts. A striking observation in this context is that when the community leaders were asked about the main strategies they use to react to such problems, the prevalent answer that they gave was “none”. It is therefore clear that despite the recurrent difficulties at play there is no common strategy elaborated to counteract them. Agricultural cooperatives are present in high number among most of the communities and are used primarily for sharing knowledge and to collaborate in the physical activities on farm. Finally, as it was already underlined in previous sections, access to drinking water, especially for private use, is rare and therefore constitute a critical area for improving standards of living in these villages.

In terms of social norms, as it was also apparent in the household part of the report, the community data show that gender discrepancies are still widespread. In 78% of the communities only men are allowed to own land and in 62% of them widowhood is still a common practice. The latter consists in the inheritance of the wife of a diseased man by his brother or another male relative.

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Appendices

Appendix 1: Summary of Household Questionnaire, GARBES 2014

Section	Module	Respondent	Unit of analysis	Unit of measurement	Specific Modules	Supporting equipment
A	COVER PAGE	Head of the Household (consent form) Enumerator (HH information)	Household	Household Codes Geographical Codes	• Consent form • Household Location • GPS Coordinates • Survey Staff Details • Household Information • Household re-contact	GPS A (Back of the Page) Codes
B	HOUSEHOLD ROSTER	All Household Members [Individuals 12 years or older should respond for themselves] MEMBERS 14 YEARS OR OLDER {Marital Status} ONLY FOR MEMBERS 7 YEARS OR OLDER {other questions}	Individual	Various (age, others qualitative)	• Relationship to the Head • Sex • Age • Months lived in the HH • Marital Status • Education • Employment • Wage • Months/Weeks/Days • Unavailability to work • Illness	B (Back of the page) Labor Codes
C	CHILD ANTHROPOMETRIC	Parents/ CAREGIVER	Individual Children age	Weight in Kilograms Heights in Centimeters	• Age • Weight • Height • Length	Weighting scale Height scale

			0-59 MONTHS.		• Arm circumferences • Reason for missing	
D	WOMEN ANTHROPOMETRIC	EACH WOMEN OF REPRODUCTIVE AGE (15-49 YEARS) IN THE HOUSEHOLD	Individual	Weight in Kilograms Heights in Centimeters	• Age • Weight • Height • Reasons for missing anthropometry	Weighting scale Height scale
E	AGRICULTURAL LAND	Head of the Household or other knowledgeable member	PARCELS OF LAND USED BY THE HOUSEHOLD IN THE LAST COMPLETED SEASON	Area codes	• Types of farming • Source of water • Means of irrigation • Types of irrigation • Types of soil	GPS [For 200 selected households]
F	CROP INPUTS (SOIL CONSERVATION)	Head of the Household or other knowledgeable member	Plots	Quantity	• Soil conservation methods • Manure • Fertilizer • Number of trees • Soil erosion	F (back page) Codes
G	CROP PRODUCTION	Head of the Household or other knowledgeable member	CROPS GROWN BY THE HOUSEHOLD	Area Unit Quantity Codes	G1 Crop production G2 Crop Inputs (costs) G2 (back of the page) G3 Crop Inputs (labor) G Crop Flap G4 Crop Inputs (seeds)	1) THE '50 BEANS GAME' ONLY FOR MULTIPLE CROPS IN A PLOT 2) Crop Flap
H	CROP SALES	Head of the Household or other knowledgeable member	CROPS GROWN BY THE	Quantity Unit GHC	• Use of crops product	Crop flap

			HOUSEHOLD			
I	CROP STORAGE	Head of the Household or other knowledgeable member	CROPS GROWN BY THE HOUSEHOLD	Qualitative Quantity Unit	• Quantity stored • Storage facility	Crop Flap
J	LIVESTOCK	Head of the Household or other knowledgeable member	Livestock the Household owns	Number and value in GHC Animal feeding in GHC	• Livestock ownership • Livestock feeding	
End of first visit						
Section	**Module**	**Respondent**	**Unit of analysis**	**Unit of measurement**	**Specific Modules**	
K	AFRICA RISING	Head of the Household or other knowledgeable member	Household	Qualitative	• Source of information • Africa RISING Activities	
L	OTHER INCOME	Head of the Household or other knowledgeable member	Other income activities of the household	Months/GHC	• List of other income activities • Responsible for such activities • Monetary value of the activity • Contribution of the activity to the overall household income	
M	CREDIT	Head of the Household or other knowledgeable member	Credit/Loan of the Household	Qualitative/Dichotomous GHC	• Use of the credit	
N	HOUSING	Head of the Household or other		Qualitative	• Materials dwelling	

		knowledgeable member	Assets	Number and values of assets	• Access to water • Toilet • Electricity/Cooking fuel/firewood • Value of the asset	
O	WELFARE & FOOD SECURITY	Woman in the Household	Household Food security	Qualitative	• Perception on food security • Perception on household food variety	
P	FOOD CONSUMPTION	Household Head and the Spouse (Together as Appropriate)	Household Food Consumption	Quantity/Unit	• Food consumption in the household • Food consumption outside the household	
Q	NON-FOOD CONSUMPTION	Household Head and the Spouse (Together as Appropriate)	Household Non-Food Consumption	GHC	• Q1 Past One Week • Q2Past 12 Months	
R	RECENT SHOCKS	Head of the Household or other knowledgeable member	Recent Shocks to Household Welfare	Qualitative	• Negative events experienced by the household in the past five years	
End of the Survey (Incentive)						

Appendix 2: Distribution of interviewed households in Control Communities, GARBES 2014

Region	District	Community	Control	ARNB	AR2013	AR2014	Total
Northern	West Mamprusi	Arigu	20	0	0	0	20
Northern	West Mamprusi	Basigu	20	0	0	0	20
Northern	Savelugu	Disiga	20	0	0	0	20
Upper West	Nadowli	Fian	20	0	0	0	20
Upper West	Wa East	Goripie	20	0	0	0	20
Northern	Savelugu	Gushie	20	0	0	0	20
Upper West	Nadowli	Issa	20	0	0	0	20
Northern	Savelugu	Kadia	20	0	0	0	20
Northern	West Mamprusi	Karemiga	20	0	0	0	20
Northern	Savelugu	Kpelung	20	0	0	0	20
Northern	Savelugu	Kukobila	20	0	0	0	20
Northern	West Mamprusi	Kukua	20	0	0	0	20
Northern	West Mamprusi	Laogri	20	0	0	0	20
Northern	Savelugu	Nabogu	20	0	0	0	20
Northern	West Mamprusi	Namiyila	20	0	0	0	20
Upper West	Nadowli	Naro	20	0	0	0	20
Northern	Talensi-Nabdam	Nasia	20	0	0	0	20
Northern	Nadowli	Pigu	20	0	0	0	20
Upper West	Wa West	Sa Gie	20	0	0	0	20
Upper East	Savelugu	Shia	20	0	0	0	20
Upper West	Nadowli	Tabiase	20	0	0	0	20
Upper West	Wa West	Tanina	20	0	0	0	20
Northern	Savelugu	Tindan	20	0	0	0	20
Upper West	Nadowli	Wogu	20	0	0	0	20
Upper East	Talensi-Nabdam	Yenduri	20	0	0	0	20
Total			500	0	0	0	500

Appendix 3: Distribution of interviewed households in Intervention Communities, GARBES 2014

Region	District	Community	Control	ARNB	AR2013	AR2014	Total
Upper East	Kassena-Nankana	Bonia	0	8	24	6	38
Northern	Savelugu	Botingli	0	4	17	7	28
Northern	Tolon-Kumbungo	Cheyohi No. 2	0	8	22	6	36
Northern	Savelugu	Duko	0	6	24	8	38
Northern	Tolon-Kumbungo	Gbanjon	0	8	25	6	39
Upper East	Kassena-Nankana	Gia	0	8	14	7	29
Upper West	Nadowli	Goli	0	7	16	7	30
Upper West	Nadowli	Goriyiri	0	1	17	3	21
Upper West	Wa west	Guo	0	8	11	6	25
Upper West	Nadowli	Gyilli	0	8	29	6	43
Northern	Savelugu	Jana	0	8	14	4	27
Northern	Savelugu	Kpallung	0	8	24	6	38
Northern	Tolon-Kumbungo	Kpirim	0	1	11	4	16
Upper West	Nadowli	Natodor	0	8	24	6	38
Upper West	Wa West	Nyagli	0	8	13	6	27
Upper East	Kassena-Nankana	Nyangua	0	10	16	6	32
Upper West	Nadowli	Papu	0	8	16	7	31
Upper West	Wa West	Pase	0	9	13	1	23
Upper East	Bongo	Sabulungo	0	8	34	7	49
Upper West	Wa West	Siiriyin	0	8	8	6	22
Upper East	Kassena-Nankana	Tekuru	0	8	19	7	34
Northern	Savelugu	Tibali	0	8	21	6	35
Northern	Tolon-Kumbungo	Tiborgunayili	0	8	18	7	33
Northern	Tolon-Kumbungo	Tingoli	0	8	11	7	26
Upper West	Wa West	Zanko	0	8	13	6	27
Total			0	182	454	148	784

Appendix 4: Conversion of units of measurement

The survey questionnaire allowed the respondents to express quantities such as the output for each crop in local measurement units. In order to convert all the information into kilograms we applied a two steps procedure. First we converted the measures that were directly transformable into Kg through one unique coefficient (see table). Secondly, we used information collected at the community level to convert the measures that required a crop-location specific conversion.

Conversion table

Unit	Conversion coefficient to KG
Kilogram	1
Gram	0.001
Liter	Crop – location specific
Unit of piece	Crop – location specific
Cane/basket	Crop – location specific
Bucket	Crop – location specific
120 Kg maxibag	120
100 Kg maxibag	100
50 Kg minibag	50
Ox-cart	Crop – location specific
Trailer	Crop – location specific
Lorry	Crop – location specific
Headload	Crop – location specific
Bunch	Crop – location specific
Bale	Crop – location specific
Sachet/tube	Crop – location specific
Plate	Crop – location specific
Cup	Crop – location specific
Heap	Crop – location specific
Bowl	Crop – location specific

To construct the crop-location specific coefficients we took the median of the conversion factors by crop, unit and location reported by the community leaders. When possible, we attributed crop-district specific coefficients of conversion. If this information was not available at the district level, we moved one level up and attributed crop-region specific coefficients. Finally, when regional information was also not available, we used crop-specific coefficients for the entire sample. As a final refinement, we replaced all the coefficients that differed more than 2 standard deviations from the unit-crop specific mean with the mean itself.